Vol. 42 OCTOBER, 1948 No. 2
Published in two sections — Part 1

NATIONAL FIRE PROTECTION ASSOCIATION

Quarterly

Published Quarterly at Boston, Mass., by the
NATIONAL FIRE PROTECTION ASSOCIATION
International

Complete

FIRE PROTECTION

has 3 vital phases

- ***EXTINGUISHMENT***
- ***PREVENTION***
- ***DETECTION***

Are you sure that each of these links in your fire protection program is as strong as it should be? A careful analysis of your fire hazards now . . . in the light of recent developments in fire protection methods and equipment . . . may save you staggering fire losses later.

Let CARDOX . . . a leader in all three phases of fire protection . . . help you make this property-protecting check-up! The only cost to you is a small investment in time.

CARDOX offers all THREE

EXTINGUISHMENT

Through Cardox engineered applications of low-pressure carbon dioxide. Cardox Fire Extinguishing Systems—broad-scale protection with storage capacities of 500 pounds to 125 tons of Cardox CO_2. Mobile units with capacities of 750 pounds to 3 tons. Bulletin S-8108.

PREVENTION

Cardox Atmosphere Inerting Systems provide inert gas for continuous fire and explosion protection of a wide range of hazardous storage, handling and processing operations. Bulletin C-8108.

DETECTION

Cardox Detection Systems, actuated by heat, smoke, or flame, give prompt warning of incipient fires—or may be engineered to actuate an extinguishing system.

CARDOX CORPORATION • **Bell Building, Chicago 1, Illinois**

District Offices: New York • Philadelphia • Pittsburgh • Cleveland Detroit • Los Angeles • San Francisco • San Diego • St. Louis

National Fire Protection Association
INTERNATIONAL

The non-profit, technical and educational membership organization devoted to reduction of loss of life and property by fire. More than 12,000 members.

JOHN L. WILDS
President
A. H. S. STEAD
Vice-President
HOVEY T. FREEMAN
Secretary-Treasurer
GEORGE W. ELLIOTT
Chairman Board of Directors

PERCY BUGBEE
General Manager
ROBERT S. MOULTON
Technical Secretary
HORATIO BOND
Chief Engineer
WARREN Y. KIMBALL
Engineer
CHARLES S. MORGAN
Engineer
JAMES K. MCELROY
Assistant Technical Secretary
GEORGE H. TRYON, III
Assistant Technical Secretary
CHESTER I. BABCOCK
Fire Record Dept.
MELVIN R. FREEMAN
Public Relations Manager
BEATRICE L. FINLEY
Chief Clerk
PHYLLIS L. DE PLOEY
Asst. to Technical Secretary
MARGUERITE C. CHAFFIN
Fire Record Dept.

THE QUARTERLY

ROBERT S. MOULTON
Editor
MARY JANE SAWYER
Editorial Assistant
CHARLES S. MORGAN
Advertising Manager

QUARTERLY

of the

NATIONAL FIRE PROTECTION ASSOCIATION

60 Batterymarch Street, Boston 10, Mass., U. S. A.

Vol. 42 October, 1948 No. 2

CONTENTS

Montreal, Canada, Fire..... Frontispiece
Self-Service Gasoline
Editorial 67
Fire Loss Statistics
Editorial 68
Hartford Did It!
James K. McElroy..... 70
Magnetic Separators
R. G. Shepherd..... 79
Fukui Earthquake and Conflagration
George W. Angell..... 83
South St. Paul Stockyards Fire..... 90
Santa Monica Hotel Fire..... 92
Fire Does Not Wait for Sprinklers..... 94
Hexane Explosion, Seattle..... 96
Soybean Mill Fire, West Memphis..... 98
Louisville Refinery Fire..... 100
Fires and Fire Losses, Classified, 1947..... 103
Hangar Fires in 1948..... 111

Accounts of fires appearing in the Quarterly are copies of or extracts from reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

Subscriptions to the QUARTERLY are accepted only as a part of the general publications of the Association which are sent to members. Associate membership is open to anyone interested; annual dues $12.50, of which $5 is for subscription to the QUARTERLY.

Entered as second-class matter December 15, 1928, at the Post Office at Boston, Mass., and Framingham, Mass., under act of March 3, 1879.
Copyright, 1948, National Fire Protection Association

Len McAllister.

Two 1000 ft. long wooden freight sheds, some 150 freight cars and contents were destroyed in Montreal on Aug. 23 with a loss reported by the Fire Department at $750,000 and by newspapers at from $1,000,000 to $6,000,000. The fire started in a truck as a result of attempts to clear a clogged gasoline line with compressed gas from a cylinder, but the main lesson is found in the excessive area of combustible construction and contents resulting in a fire far beyond control by the fire department, despite the use of 60 hose streams.

The Quarterly

Vol. 42 October, 1948 No. 2

Self-Service Gasoline Self-service, first widely used in chain store food retailing, is now being introduced in gasoline stations. The fire record of filling stations of conventional type has in general been good, in view of the inherently hazardous nature of gasoline. Now self-service is a new factor in the picture. Some fire protection authorities view this development with alarm; some others have apparently not been concerned. For example, the city of Los Angeles prohibits self-service gasoline stations, while a number of such stations are in full scale operation in surrounding communities. Oregon has a state regulation prohibiting gasoline self-service, and ordinances to this effect have been adopted by various cities.

The NFPA thus far has taken no official position on this development and there are no provisions in NFPA standards which could be construed to prohibit gasoline self-service. In 1946 the NFPA Committee on Flammable Liquids considered a proposed amendment to the Flammable Liquids Ordinance which would have prohibited discharge of gasoline from service station pumps except when handled by service station operators or their authorized representatives. This proposed amendment was directed against coin operated pumps in unattended stations, the reasoning being that it would be unsafe to make gasoline available to the general public without supervision, as this might lead to handling of the gasoline hose nozzle by intoxicated or irresponsible persons who might be smoking or light matches, its delivery into improper containers or its use for improper purposes, all with increased fire, explosion and personal injury hazard. However, the committee considered the arguments of the proponents of these devices, who emphasized the need of having gasoline available to motorists at night and in remote areas at times when gasoline stations of the conventional type are closed, and stated that every possible safeguard had been provided in the design of the gasoline vending device. An essential feature is an automatic nozzle through which gasoline will flow only when the nozzle is fully inserted in the fill opening of the automobile tank and which shuts itself off when the tank is full, thus preventing overflowing of tanks when filling and careless discharge of gasoline on the ground from a nozzle not properly inserted in the fill opening. After hearing these arguments, the NFPA committee withdrew its proposed report pending further consideration, and has deferred any further recommendation in view of the impending complete revision of the Flammable Liq-

uids Ordinance which is now in process in the committee. Meanwhile a number of coin-operated gasoline pumps are in service in various parts of the country, but the economics of gasoline distribution do not appear to indicate any very widespread development of this type of gasoline vending.

The attended type of self-service station is entirely different. It is a booming business in certain areas, particularly in Southern California. Here the motorist fills his own tank, under the supervision of a man in a control tower who directs traffic to the various pumps and uses a public address system to warn motorists to stop their engines and to refrain from smoking, though questions have been raised as to how good a job can be done by one man in supervising the operation of 25 to 50 or more gasoline pumps. Attractive girl attendants circulate among the pumps to collect money and make change. In some cases the girls wear roller skates to get around quickly, but this is not an essential feature of the operation. If the motorist wants oil, water, air or windshield cleaning he moves to another location away from the pumps.

These self-service gasoline stations sell "gas" at five or six cents per gallon less than the established price at service stations of the conventional type and there is good reason for believing that their main appeal is that of low price. The price differential is greater than the normal profit margin of the ordinary gasoline retailer and their operation thus depends upon a low price source of wholesale gasoline, just as in the case of a cut-price gasoline station of the conventional type. The self-service station as currently operated does little business in accessories, tires, lubrication and other related services which provide a good part of the profit of the ordinary gasoline stations. Without regard to any questions of fire hazard which might prohibit or restrict this type of operation, there is considerable doubt as to whether the economics of the situation are such that self-service gasoline distribution will spread like self-service food stores.

The fire hazard aspects of self-service gasoline operations have yet to be determined. There is an undoubted hazard in large scale operation of gasoline pumps by the ordinary motorist. The principal elements are the possibility of failure of automatic devices, and the possible failure of supervision to prevent smoking and other carelessness. All this must be considered in comparison with the conventional type of gasoline stations where operators are not always perfect and equipment is sometimes not properly maintained. No fires in self-service gasoline stations have as yet been reported to the NFPA. Eventually the fire record should answer all questions as to the fire hazard of self-service as compared with gasoline dispensing by station employees. Considering the inherent hazard of the product handled, gasoline service stations have had a very good fire record, due to the use of underground tanks, approved pumps and other features recommended by NFPA standards. It remains to be seen how this record may be changed by the advent of gasoline self-service.

Fire Loss Statistics In this QUARTERLY, we present NFPA estimates of the U. S. fire loss for 1947, based upon reports from state fire marshals. These figures are not intended as exact statistics, but indicate the relative extent of the fire loss, and its distribution by causes and occupancy classifications. Also widely quoted are the monthly and annual loss estimates released by the National Board of Fire Underwriters, based upon loss re-

ports by their group of reporting insurance companies, with a percentage added to cover uninsured and unreported losses. All these statistics are valuable, but NFPA members should hold no illusions that any published figures on fire losses reflect any more than a fraction of the total National fire waste. We believe that the grand total of fire losses of all kinds, if there were any practicable method for compiling all of the many kinds of loss, might prove to be several times as great as the highest published figures.

Most fire loss figures, through whatever source reported, are to a large extent based on fire insurance loss payments. Granting that the agreed settlement of a fire loss under the terms of a fire insurance contract is the best available determination of the amount of the loss covered by the individual fire insurance policy, there still remain many uncertain factors, such as the extent to which property is uninsured or underinsured, indirect losses such as interruption of business or losses of records which are reflected in loss statistics only when insured, losses in airplanes, trucks, vessels and goods in transit which are covered by forms of insurance which do not differentiate between losses from fire and those from other hazards, and various intangible losses too numerous to mention. There is no certainty, even, that there is any fixed relationship between reported and total fire losses. In fact, there may be reason to suspect that total losses are increasing at a greater rate than the reported figures.

Inflation is obviously a major factor in present-day dollar fire losses. Today, a fire causing the same physical damage as a similar fire before the war represents about twice the dollar loss, and on this basis, current fire loss figures should be substantially discounted. There are, however, some offsetting factors, particularly the fact that many property owners have not increased their fire insurance in proportion to inflated values, with the result in case of fire the insurance loss payments are considerably less than the actual loss, and that there is an increasing amount of property that is not insured at all, both government and privately owned.

Even in the case of figures based upon insurance payments, there may be opportunity for discrepancies owing to differences in method of collection and compilation of information. For example, in the state reports published by the NFPA, Oregon has consistently shown a per capita fire loss about double that of other comparable states. No adequate explanation can be found in either physical or moral factors to account for this difference, which leaves the conclusion that the difference is due to a more complete reporting service in Oregon, and that the National totals might be doubled if a similarly complete reporting procedure were followed everywhere.

As a result of years of fire prevention educational effort, nowadays no one is proud of having a fire, and the natural human tendency is to minimize the seriousness of the loss. We have no way of knowing to what extent small losses are concealed and not even reported to insurance companies, but this is another factor tending to cast doubt upon the accuracy of fire loss statistics.

We glibly quote statistics to emphasize the importance of fire prevention and fire protection and with this there should be no argument, for whether true losses are taken at half the reported totals to allow for the effects of inflation, or whether they are two or three times as large as reported, the fire waste is inexcusably great and a serious drain upon the economy of the country.

Hartford Did It!

By James K. McElroy
Assistant Technical Secretary, NFPA

If you are a member of the traveling public that spends a good portion of its time in hotels, come to Hartford, Connecticut — you'll probably live longer. This well-run capital of the Nutmeg State has gone "all-out" to protect the lives of those who stay in the city's 27 hotels.

While a tangle of legal red tape in most cities bogs down common-sense correction of hazardous conditions uncovered as a result of the 1946 U. S. hotel fire epidemic which took over 200 lives in six short months in only three major hotel fires, Hartford officials have moved with quiet New England efficiency to protect their traveling public. They accomplished their objective without recourse to a single court order. The city-wide project was initiated in 1944 under trying war-time conditions.

Visitors to Hartford, whether they be itinerant tobacco field workers or the nation's top industrial or political figures, are assured of equal protection for their lives in the hotel of their choice. Visitors may be struck with the fact that none of Hartford's hotel managements advertise to the public that, where required, the buildings are protected throughout with automatic sprinklers; that open stairwells have been enclosed; and that there is a direct manual fire alarm connection to the Hartford Fire Department headquarters from all the hotels. One hotel manager summed it up when he said, "Why should we advertise? Everyone else in the business in this town has the same protection."

Some appreciation of the magnitude of the problem of life safety in Hartford's

Trumbull St., Hartford, Conn. The New Dom, the Embassy, the Savoy, and the Trumbull Hotels are all brick, wood-joist buildings completely protected with automatic sprinklers throughout, as are all of Hartford's hotels of similar construction.

hotels is indicated by an estimated hotel property valuation of $5,000,000. Approximately $500,000 was expended in the protection of vertical openings, the provision of additional means of egress and other structural changes. About $300,000 additional expenditure was necessary for the installation of automatic sprinklers in the drive to make Hartford's hotels safe.

The Program

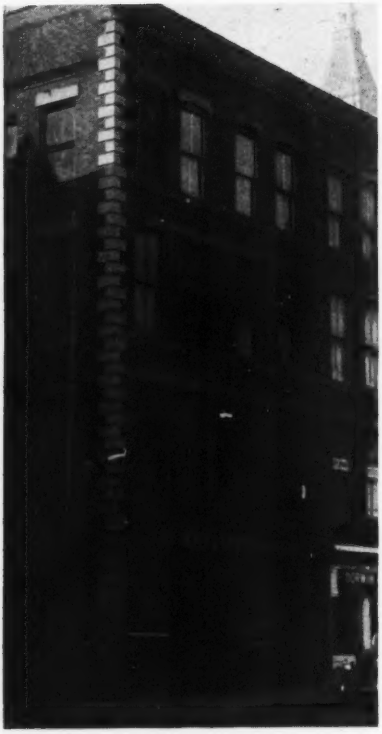
Such a program does not just happen! Henry Thomas, Fire Chief, and William J. Ennis, Building Supervisor, are modest men. Each declines to accept the credit for the initiation of the program of improvement in Hartford's hotels. The inspection staff of the Building Department in 1944 included three men with a million dollar backlog of applications for building permits. The fire department was similarly handicapped. In the winter of 1944, Chief Thomas and Mr. Ennis, legally responsible for the enforcement of the city's building laws and fire prevention ordinances, met and decided that the best use of their limited manpower was to concentrate on an important occupancy in joint inspection and jointly issued orders on the owners of the properties where required. A $50,000 hotel fire at Christmas time in 1944 indicated the choice of hotel properties as a primary target for Fire and Building Department activities.

The Allyn House, Hartford, Conn. A 125-room hotel in the upper floors of a bustling multiple occupancy mercantile and office building. All areas of the building are protected by an automatic sprinkler installation, stairways are enclosed, and there is a manually operated fire alarm box directly connected to the Hartford Fire Department headquarters.

The age-old question as to whether or not the requirements for exits and other structural safeguards of the building code in effect in 1944 could be made to apply retroactively to hotel properties was answered by a legal interpretation* of the existing laws and ordinances in Hartford by Samuel H. Aron, then Corporation Counsel. The Building Department was found to have the power to issue orders for "the maintenance, repair or removal of all such walls, buildings or structures if upon examination such structures are found to be unsafe and dangerous."

*Partial quotation from letter dated Jan. 13, 1945, addressed to Building Department:

"As we interpret your request, the opinion called for covers the general situation. To avoid any confusion, we call to your attention a possible situation where exits from a building which did conform to the (Hartford) Building Code at the time the building was built may be ordered changed. This is where the present exits are found to render the building unsafe or dangerous. In such a case, under the authority of Section 142 of the Revised Charter (Hartford) your department has the power to issue orders for 'the maintenance, repair or removal of all such walls, buildings or structures if upon examination such structures are found to be unsafe and dangerous.' The Building Code has implemented this charter provision. Your orders, however, for a change in existing exits based upon that power stems from it and not from any change in the Building Code. Thus, the orders for a change in the exits would be not that they conform to the existing code, but rather that they be so altered as to render the building safe for use. In some cases the practical result would be the same, while in others you could depart from the provision of the code and order such changes as you may deem fit and necessary in the particular case."



The Gaylor Bros. Hotel, located in Hartford's warehouse district, has the same protection for its patrons as its more opulent competitors.

The Fire Department at that time did not have legal authority to require the installation of fire protection equipment in hotels. However, Chief Thomas, then Fire Marshal, and Building Supervisor Ennis were determined to work together in the program, depending more on their sales ability than their legal position to obtain the desired results.

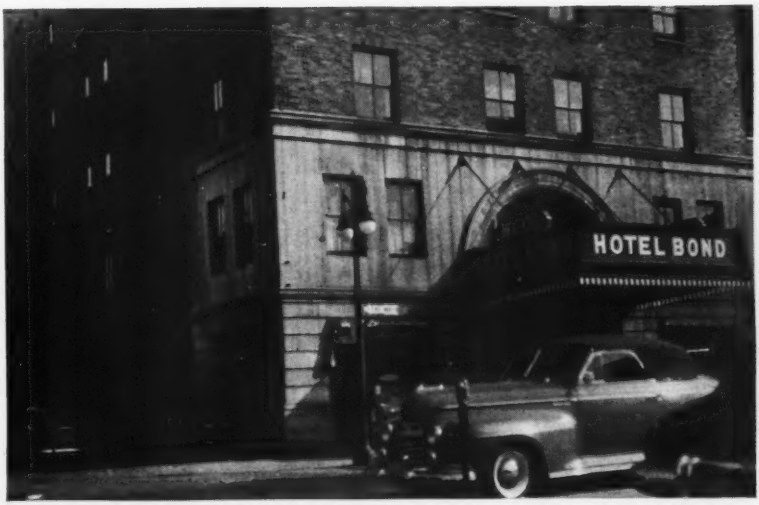
The Fire Prevention Committee of Hartford's Chamber of Commerce had long actively supported all community fire prevention and fire protection programs. The hotel safety project was no exception. From the first, the committee, under the chairmanship of Mr. John Ashmead of the Phœnix Insurance Co., joined forces with Chief Thomas and Supervisor Ennis in providing assistance in selling the program to all those affected by it.

A review of the orders issued to hotel owners in the early days of the program indicates the type of corrections ordered. A random sample from the files follows:

Cellar ceiling to be protected with fire-resistive material.
Provide fire doors on the entrance to the basement boiler room and provide adequate ventilation.
All stairways are to be enclosed.
Clean up rubbish in the alley.
Clean out rubbish from the rooms on the.... floor.
Provide panic hardware on exterior exit doors.
Remove combustible partition for boiler room.
Provide an additional exit from the....floor.
Remove material obscuring exits on the ground floor.
Provide illuminated exit signs at the exits on all floors.
Storage room on....floor to be cleaned up and rubbish regularly removed.
Electrical wiring defects to be corrected.
Remove revolving door or provide additional exit facilities.
Provide a fire escape from the....floor to the ground.

There were many other corrections ordered. Some required priorities for scarce materials during the war years, but the priorities were forthcoming when it was shown that the materials were necessary for the protection of life. Not all the hotel managements could be expected to be, or in fact were, cooperative. Some, as might be expected, cooperated fully. Both the Fire and Building Departments had the firm backing of the city administration.

The LaSalle Hotel fire (June 5, 1946, NFPA *Quarterly* July 1946), provided an object lesson to the hotel industry. It is interesting to note that the joint orders



The ballroom on the 11th floor of the Hotel Bond, Hartford, Conn., had but one safe means of egress directly to the street prior to Hartford's hotel safety program. A second means of egress from the ballroom was provided by extending an enclosed stairway from the 10th floor to the ballroom, and the installation of an outside fire escape at the 2nd floor (in shadow at left) which avoids discharge of the occupants through the lobby. (See Guide for Hotel Fire Safety Law—1948, NFPA.)

issued for corrections just prior to the LaSalle Hotel fire contained the significant recommendation to the owners of hotels of brick and wood joist construction not already fully protected by an automatic sprinkler system that serious consideration be given to the installation of such systems throughout the hotel buildings of that type of construction.

On July 8, 1946, the Court of Common Council at its regular session under suspension of rules adopted the following ordinance by unanimous rising vote, and it was approved by the Mayor on July 9th:

ORDINANCE REGULATING FIRE ALARM SYSTEMS IN ESTABLISHMENTS HOUSING THE PUBLIC, IN HARTFORD, CONNECTICUT.

SECTION 8-52

ORDINANCE PROVIDING FOR FIRE ALARM SYSTEMS IN ESTABLISHMENTS HOUSING THE PUBLIC.

Be it Ordained by the Court of Common Council of the City of Hartford:

Sec. 1. General laws for diminishing danger to life, health and safety in the case of fire.

Sec. 2. On and after October 1, 1946, every asylum, almshouse, orphanage, convalescent home, hospital or hotel having provision for the care of twenty-five or more inmates shall be equipped with one or more fire alarm boxes of the type and character suitable for connection with the system used in the City of Hartford, and such alarm box or boxes shall be located on the premises or in the buildings on such premises. Such fire alarm box or boxes shall be inspected by and meet with the approval of the Chief of the Fire Department or his accredited assistants.

Sec. 3. The expense of acquiring, installing and connecting such fire alarm boxes and fire extinguishing equipment shall be borne by the person, firm, or corporation owning or operating such asylum, almshouse, hospital, orphanage, convalescent home, or hotel. Upon the installation of such fire alarm boxes the Chief of the Fire Department shall cause such fire alarm boxes to be connected to the general fire alarm system in the City. Master box connecting to the City Fire Alarm system shall be maintained in good repair by the Chief of the Fire Department, or his accredited assistants, who shall have the right of access to each fire alarm box at

The Garde Hotel, Hartford, Conn., located on through Highway 5-A, suffered a $50,000 fire, without loss of life, at Christmas time in 1944. It is now protected throughout with automatic sprinklers, though travelers see no exterior indication of this protection.

any reasonable time for the purpose of inspection and testing.

Sec. 4. All such establishments as mentioned in Section 2 shall be provided with such fire extinguishing equipment as deemed reasonable and necessary by the Chief of the Fire Department or his accredited assistants.

Sec. 5. The Town Clerk shall cause the ordinance to be published in a newspaper having a general circulation in the City, within two weeks after adoption by the Court of Common Council.

Sec. 6. Any person, firm, corporation or association violating any of the provisions of this ordinance, in addition to the revocation of his or its license, shall be liable to a fine of not more than $50.00 or imprisonment of not more than 30 days or both.

Under Section 4 of the Ordinance, it will be noted that the Fire Chief was given the authority to require such fire extinguishing equipment as he "deemed reasonable and necessary." Thus did the previous life safety recommendations (that automatic sprinkler systems be installed, where required) made by Chief Thomas and Building Supervisor Ennis take on the authority of law.

Section 2 of the ordinance provided the authority for the Fire Chief to require one or more fire alarm boxes with direct connection to the Hartford fire alarm system in an effort to avoid the curse of delayed alarm to fire departments common in hotel fires throughout the country.

Chief Thomas recognized that the passage of the ordinance would not be sufficient by itself to reach the goal. All manner of problems would have to be solved! Financing, procurement of materials, and labor to install the required sprinkler protection, and above all, the enlistment of the cooperation of the hotel managements.

Willard B. Rogers, President and General Manager of the Bond Hotel Corporation, and staunch friend of the Hartford Fire Department for many years, recommended to his Board of Directors the expenditure of the funds necessary to make the structural corrections and the installation of the sprinkler systems and alarm boxes, which eventually required an expenditure of $172,000 in three hotels owned and operated by his company.

Mr. Rogers told me: "Not only do my guests sleep nights, but I do. We put life safety ahead of dollars in our reserve fund and are happy about it! In one of our hotels, the provision of a new enclosed exit on the outside of the building made it possible to floor over the old open stairway, which gave space for two additional rooms for rental on each floor of the 7-story building!"

Another hotel manager told me (in referring to the many conferences he had had with the Building and Fire Department officials about the legality of the ordinance requirements), "It was an even contest and the guy that sleeps in our hotels won!"

Sprinkler protection for the corridors of the fire-resistive sections of the Bond Hotel is unobtrusive. Manual fire alarm box at the left is directly connected to an audible alarm and to the Hartford Fire Department.

Adolph Gaylor, partner in the operation of the Gaylor Bros. hotel, who had been threatened with legal action to force the issue, told me with shining, happy eyes, "I spent $15,000 to protect my boys! I don't even own the building. They are good boys even though they may not have much money and a bottle of whiskey is never far from most of 'em." It is important that once the Gaylor Bros. understood Chief Thomas' goal, the threatened legal action never came to court.

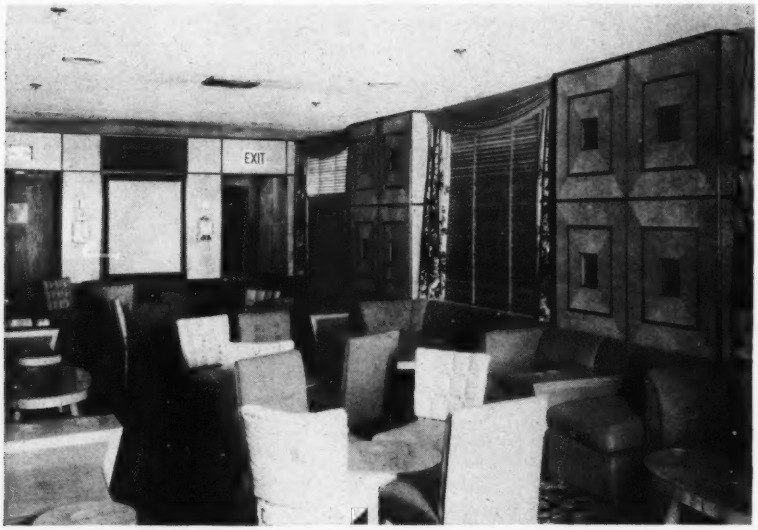
Constant pressure for improvement caused four occupancies classified as hotels to voluntarily change to office building or other occupancy in which the danger to sleeping transients would not be present.

Problems

The acceptance of the required protection by Hartford's hotel industry was aided by the Winecoff disaster (Dec. 7, 1946—NFPA *Quarterly* January 1947). It then appeared that the project would proceed to completion without further complications. In addition to structural changes, automatic sprinkler protection was required for 21 hotel buildings. The installation of sprinkler systems without interference with normal hotel operations was one problem. Variation from the normal practice of shop cutting of sprinkler piping was another. The lack of available sprinkler fitters in the New England area was an unexpected obstacle.

Realizing the importance of the Hartford hotel safety program, three firms signed contracts with the owners of the buildings for the sprinkler protection. The Grinnell Co. (14 installations); the Hartford Sprinkler Co., licensee of the Hodgman Mfg. Co. (4 installations), and Thomas G. Shaffer, Inc., licensee of the Reliable Automatic Sprinkler Co. (3 installations), placed a high priority on the hotel work in Hartford and pushed the installation of 21

Sidewall sprinklers unobtrusively protect the patrons of the Embassy bar, on the street floor of the Embassy Hotel, Hartford, Conn., completely sprinklered throughout its five floors and basement.



The Adajian Hotel Lounge. Sprinkler piping is concealed in the ceiling and modern sprinklers do not impair the attractiveness of one of Hartford's most popular restaurants.

sprinkler systems to completion. Materials shortages developed, and some were licked by the importation of certain materials from abroad. Manpower shortages were licked when sprinkler fitters were brought to Hartford from the South and mid-West. Problems of financing for a time threatened to stop the program, but ways and means were found to obtain the funds for the various projects locally.

Of the 27 hotels, 5 are of fire-resistive construction throughout, 20 are of masonry wall and wood joist construction, and 2 combine both fire-resistive construction and masonry wall and wood joist construction in the same fire area. The masonry-wood-joist buildings (except one in process of completion) are sprinklered throughout, six with "Sprinklarm" connection to the manual fire alarm box in the hotel building. One fire-resistive hotel building has been provided with sprinkler protection in the corridors, stairways, janitor closets, the basement, kitchens and storage rooms. All have direct manual fire alarm box connection to the Hartford Fire Department.

For the benefit of hotel owners who may resist the installation of sprinkler protection on the ground of loss of revenue from the rental of rooms while the work is in progress, it is important to report that in only one case did the owner complain of loss of revenue, only $500 in rental loss over the several months required to complete the contract. Sprinkler fitters proved that they could install piping without damage to the contents of hotel rooms or disturbance of the guests. Several hotel managements stated that the contracts took too long to complete! Once convinced, they wanted the protection for themselves and the public they served! It is estimated that the cost of the sprinkler installation to owners amounted to approximately $20 per sprinkler head.

The Gamewell municipal fire alarm system is used in Hartford, and the direct connection to the Fire Department from the corridors and lobbies of the 27 hotel buildings with audible alarms throughout the hotels was handled without incident. The space on the Hartford signal system panel permitted the addition of the 27 connections.

It is estimated that the expense of the structural corrections and the installation of automatic sprinklers will be amortized in from seven to nine years through the reduction in fire insurance rates. In Hartford, the average saving in fire insurance costs is approximately sixty per cent, based upon published rates before and after the corrections were made. No information was available as to the possible effect on the casualty insurance costs which may have resulted from the improvements in exits, etc., which have been completed.

In Hartford there was no opposition from insurance agents to structural changes and the installation of automatic sprinkler systems on the ground that the resultant reduction in fire insurance costs to the owners also reduces the commission to the insurance agent. Mr. Walter Allen, of the Allen, Russell and Allen Insurance Agency, told me, "What is good for our assured's is good for us, and I feel certain there was not one single instance where the insurance agents of Hartford were not solidly behind the public officials in fulfilling their obligations to the traveling public."

Conclusion

To sum up: common sense, persuasion and persistence were used in Hartford to enable it to challenge the rest of the world to do a better job of protecting the traveling public. In spite of undermanned staffs in the Building Department, the Fire Department, the lack of finances, materials and manpower, and the outright opposition from a few of the hotel owners and managements, the job was done. Since the completion of the project 26 alarms have been received by the Hartford Fire Department. Drunks and disorderly persons, the thorn in the side of the hotel industry, were responsible for five false alarms. But Chief Thomas says, "We would rather answer a false alarm, despicable as their senders are, than to roll and find bodies in the street as they did at the Winecoff."

The fire department also responded to one alarm of smoke, one for an ammonia leak, and one in which there was no fire but was not considered to be a false alarm. Four alarms resulted from maladjustment

The Hotel Bond, Hartford, Conn., comprises a twelve-story fire-resistive section, an adjoining six-story fire-resistive section connecting with a four-story brick, wood joist section. Corridors, stairwells, basement, pipe and other concealed spaces, janitor and linen closets in the fire-resistive sections are protected with automatic sprinklers. The brick, wood-joist section is protected with automatic sprinklers throughout.

in the new sprinkler system in which the hotel management's personnel properly pulled the manual fire alarm box upon hearing the water flow alarm.

More important to all of us who must travel on occasion, 14 alarms of fire were received, all of which were extinguished with minor damage by a sprinkler system, with the necessary follow-up by the fire department. In one instance the fire was extinguished by the fire department before the sprinklers operated.

There is no guarantee that the fool who smokes in bed may not sometime lose his life in one of Hartford's 2,925 hotel rooms, even though all reasonable precautions have been taken to prevent it. However, there is good reason to believe that he will not jeopardize other lives than his own. Sprinkler systems and exits must of course be maintained in operating condition, and continued vigilance in housekeeping, care and attention given to the special hazards of Hartford's hotels will be necessary. The life safety program only recently completed, with great odds against its success, indicates that such problems will be small ones indeed.

Great credit is due the courageous public officials who initiated this program, the Hartford hotel men who accepted the program, and all those who made it possible. The victims of the LaSalle, the Canfield and the Winecoff hotel fires have not died in vain! We who "sleep in 'em" won!

Attention Guests
FOR YOUR OWN SAFETY
Before Retiring, Know the Location of
YOUR NEAREST FIRE EXIT
Do Not Contribute to the Hazards of Fire
by Smoking in Bed
In Case of FIRE Call Hotel Operator by
Telephone IMMEDIATELY
DON'T DELAY
Connecticut Fire Chiefs Association
Connecticut Hotel Association

Connecticut fire chiefs and hotel managers cooperate in the distribution of life safety posters to all hotels.

Magnetic Separators

By R. G. Shepherd, Engineer
Associated Factory Mutual Fire Insurance Companies

When a piece of ferrous metal is struck by a rapidly moving machine part, sparks are likely to fly. This happens frequently when tramp metal in stock passes through processing machines. These sparks are actually tiny particles torn from the steel and heated to incandescence by impact, friction, and oxidation. Sometimes they carry enough heat to ignite fibers, dusts, or flammable vapors. Strange as it may seem at first thought, these sparks are one of the leading causes of fire in industry. This is borne out by an analysis of 19,485 fires at Factory Mutual plants over a recent seven-year period. Twelve per cent of these fires were reported due to foreign material in stock.

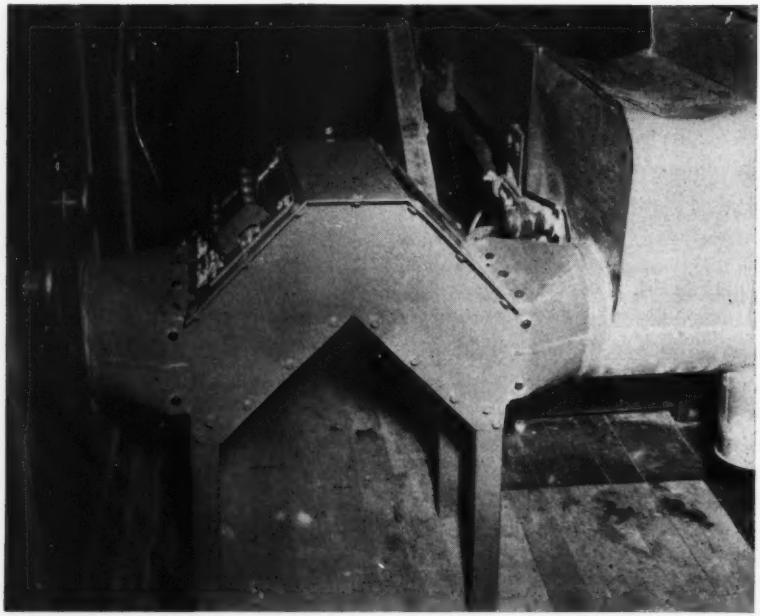
Cleaning permanent plate magnet installed in boot of grain elevator.

At cotton mills, tramp metal causes about one out of every three fires. Bale ties, nails, wire, bolts, nuts, screws, bottle caps —in fact, almost everything—has a way of getting into cotton, and when this material encounters beaters or other rotating parts of opening or picking machinery, a spark is likely to find tinder in the surrounding fluffy cotton.

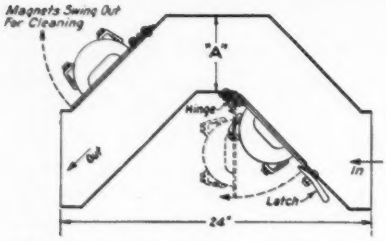
Because ferrous metal has the property of magnetic attraction as well as that of striking sparks, it was natural that engineers concerned with fire protection turned to magnetism for aid in eliminating these frequent and troublesome fires.

Magnetic separators have been used for many years in the prevention of fires and explosions at various grinding processes, to prevent contamination of food products by metal, and to assist in the separation of magnetic ores. At grain mills, coal pulverizers, grinders for pigments and plastic dusts, and at similar processes where a spark from tramp metal can touch off a dust explosion, magnetic separators are recognized as an essential safety feature.

It is only recently that magnetic separators have been used in the fight against fire at textile opener-picker processes. One of the principal investigations of the Factory Mutual Laboratories' research program on fire loss reduction in the cotton textile industry concerned magnets. With the cooperation of the manufacturers, units specifically designed for textile uses are now obtainable. Magnetic separators cannot prevent all fires from foreign material in textile stock but they do reduce their fre-



Permanent plate magnetic separator installed between cotton feed table and vertical opener.



Permanent plate magnets and housing in textile pneumatic conveyor duct.

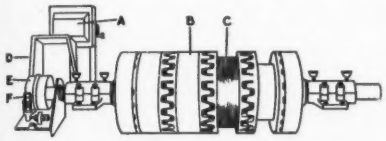
quency. One southern cotton mill had 22 opener-picker fires in a single year. Magnetic separators were then installed in each of the five opener lines, and only an average of five fires per year was reported during the three years following. Another mill reports that in addition to reducing fire frequency, separators have more than paid for themselves by preventing machine damage; "licker-in" repairs at cards were reduced 52 per cent.

Hundreds of cotton mills have already installed the separators, and this is undoubtedly largely responsible for the recent reduction of about 20% in the frequency of opener-picker fires at Factory Mutual cotton mills throughout the country.

Types of Magnetic Separators

Magnets used in the construction of separator equipment are of two distinct types: (1) electro-magnets, which consist of wire-wound pole pieces which require a reliable source of direct current for excitation, and (2) permanent (self-exciting) magnets made up of several high-intensity units. Both types are manufactured as plate and also as pulley separators. Each type of magnet possesses desirable charac-

teristics of its own. For example, a permanent plate magnetic separator may be preferable in locations where it is difficult to arrange for a proper power supply, while at other installations frequent automatic cleaning by de-energizing the electromagnet may be a desirable feature.

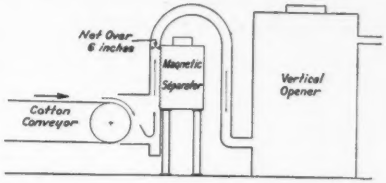


Assembly of Typical Electro-Magnet Pulley.

A. Special fully enclosed switch.
B. Covered coils.
C. Coils.
D. Dust-tight housing.
E. Collector rings.
F. Brush assembly.

One of the most important characteristics to consider in connection with the selection of a magnetic separator is the effective magnetic flux pattern, or strength of attraction at variable distances from its face. These lines of magnetic force are apt to vary considerably due to the particular construction of the magnet. Tests conducted by the Factory Mutual Laboratories have demonstrated that holding power is not a reliable indicator of the depth or reaching power of the magnetic field, which is often the most important quality to consider. Because effective magnetic attraction does not usually extend more than a few inches from the working face, it is recommended that flow of material be brought as near as possible to the separator. The size of a magnetic separator is also important. In too many installations, separators are of inadequate size for the particular job and are, therefore, not fully effective.

Electro-magnets require a dependable source of direct current. The most desirable direct current supply is from a plant power line. The magnet should be connected in circuit only by the use of a fully enclosed switch furnished by the manufacturer. This switch is designed to dissipate automatically the induced high-voltage charge of the magnet when the magnet is disconnected from the line. If two or more magnets are to be supplied from a direct current source, and a d.c. power line is not available, a motor-generator set is suggested. Suitable tube-type rectifiers are also available. All wiring should be installed to conform to the requirements of the National Electrical Code. Rectifiers or motor generator sets should be located well away from combustible fly and lint. Electro-magnets powered by motor generators or rectifiers should be equipped with a visible indicator to show loss of d.c. power.



Electro-magnet installed in textile opener line.

In cotton opener-picker rooms, the magnetic separator should be installed at the end of the conveyor just before the fiber goes to the first opener or cleaner. The separator should be located in a turn or bend in the pneumatic duct, so that a change of direction causes the cotton or foreign material to impinge on the face of the magnet. The duct housing should be the same width as the plate and not over six inches in depth. A suitably arranged drop-out box should be provided to receive entrapped pieces. For waste recovery lines, where the stock moves slowly, it is prefer-

Electro-magnetic separator (arrow) in a jute picker line.

able to locate the magnet as an extension to the feed table so that the stock passes directly over, or is worked against, the magnet face. Because installation details vary with conditions at individual textile mills, installations can best be made by manufacturers of the approved separators.

Although sometimes it is necessary with belt conveyor systems for various materials to suspend magnets over the conveyor, gravity should be used wherever possible to assist the magnetic attraction rather than to oppose it. Vibrating devices with carefully regulated speed are often required for finely divided, high density materials, especially where the metal or other foreign materials may be in small particles.

When fires take place in enclosed processing equipment, they are usually difficult to extinguish and the damage to product and equipment is quite likely to be costly. Interruption to production may also be serious. For these reasons, elimination of all possible fire causes becomes a primary requirement.

Select a magnetic separator of the right size and type to meet individual conditions. Install it properly and in the correct location — not just the most convenient one. You can then count on fewer fires from tramp metal in stock, less damage to machines, and less contamination of the product.

Fukui Earthquake and Conflagration

Report by George W. Angell*
(Member NFPA)

At 5:13 P.M. on June 28, the Japanese city of Fukui experienced a devastating earthquake. Three thousand of her 84,271 inhabitants were killed, another 10,000 were injured, and 12,312 buildings suffered between 50 and 100 per cent destruction. Investigators estimate that of these totals the conflagration was responsible for 1,500 fatalities and 2,371 totally destroyed buildings. This disaster, like the others in the long list of predecessors to have visited Fukui, has apparently failed to impress local authorities with the necessity of instituting certain obvious rules of fire protection.

It may be Oriental fatalism to accept such fires as inevitable. A strenuous attempt is being made to overcome this apathy with an educational program of fire prevention and protection. Another argument often advanced suggests that the nation is too poor to afford the expense of adequate fire prevention and fire fighting measures. It is because of this very poverty that the Japanese can ill afford *not to act* to prevent further depletion of their wealth by fires.

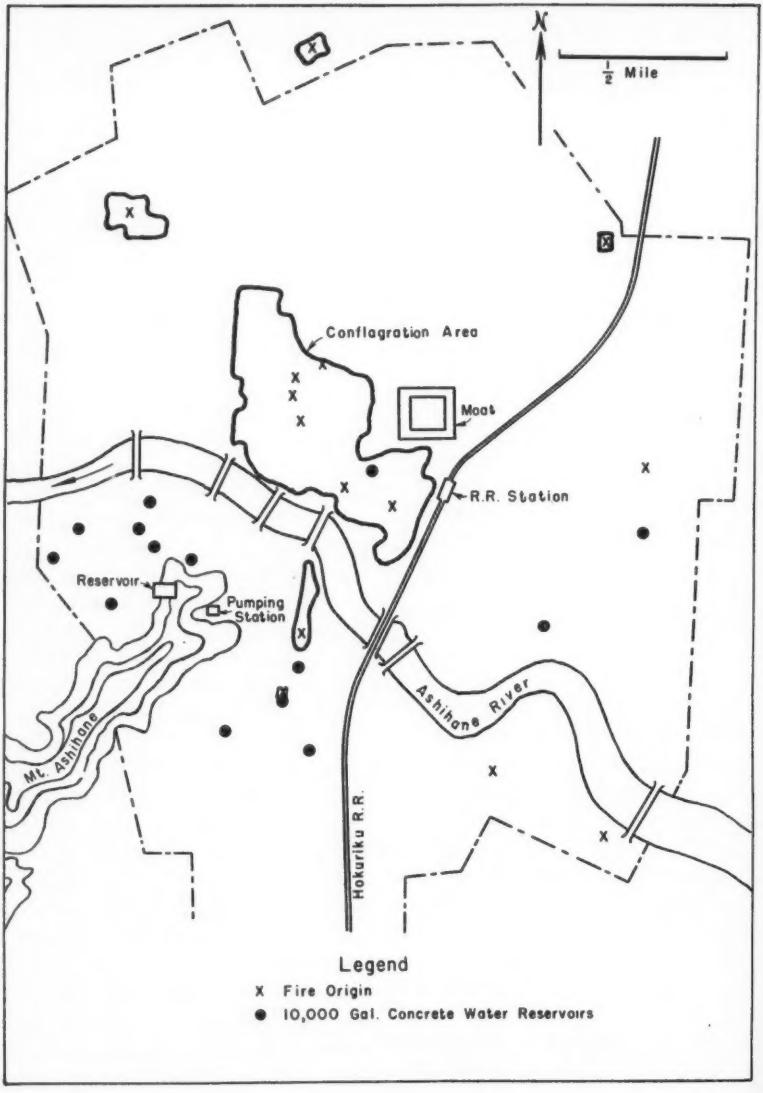
Fukui Fire History

The city of Fukui, as in the case of most cities in Japan, has experienced many conflagrations. Of the 63 recorded since 1657 twenty-six destroyed more than 100 buildings and six more than 1000. No data are available from 1868-1888 or since 1935, although it is known that by the end of World War II, 90 per cent of Fukui had been destroyed by incendiary warfare. However, as evidenced by the photographs on page 86, reconstruction was very speedy and by the end of 1947 the city was 38 per cent rebuilt (80% rebuilt in the urban area).

Fire Prevention Activity

It is logical to ask what is being done to prevent this periodic destruction by fire. In theory, city planning embodying fire prevention fundamentals is a major item in the post-war reconstruction program for Fukui. New wide roads were scheduled and old ones were to be widened and straightened. Parts of the program had been put in effect in rural areas, but in the center of the city, where the need was greatest, no attention was paid to city planning and building laws. An example is the situation that confronted road construction crews early in 1948, when work was to start on widening three streets. Approximately 370 houses had already been rebuilt along the old street boundary. Widening plans were abandoned. Building laws were also enacted to govern reconstruction of war devastated areas. Their ineffectiveness is evidenced by the manner in which the regulation requiring fire retardant roof covering was flaunted. Since passage of the law 60 per cent of new construction used wood shingle or straw roofing.

*Mr. George W. Angell, Chief Fire Administrator, Public Safety Division, Far East Command, supplied the information incorporated in this report, but owing to factors of time and distance it has not been possible to submit the proof to Mr. Angell for checking prior to publication.—Ed.



Topography

The city of Fukui lies in a valley in the west central part of Honshu (largest Japanese island). With the exception of 262-foot-high Mt. Ashihane in the southwest sector, the terrain is mostly flat. It is divided approximately in half by the Ashihane river that flows from east to west. Of its 13 square miles, four are congested with most of the city's 15,427 buildings. An

idea of the degree of congestion can be obtained from the lower photograph on page 86. The railroad station midway on that stretch of the Hokuriku railroad, running north and south through the city, is the eastern boundary of the congested district and is the focal point of the city's two trolley lines and one of its two main streets.

Water Supplies

Five sources of water in Fukui would seem to assure an adequate supply for fire fighting. The record shows that due to improper engineering, poor maintenance and earthquake damage, the least of the five, an old castle moat, was the only one to serve satisfactorily.

The city water works consisted of a system of five- and three-inch mains supplied from a reservoir halfway up Mt. Ashihane. Wells at the foot of the hill supplied the reservoir. Before the war, pressure in the center of the city averaged 40-60 psi, but in recent months had dropped to about 1 psi in the center, and even less in the outskirts, due to leakage. What little assistance firemen might have gained from the use of the 660 hydrants on these mains was denied them by earthquake damage to piping.

During the war, thirteen 10,000-gallon concrete reservoirs had been constructed in various places in the city. Except for two or three damaged in the war or by the earthquake all were in good condition. Some of these were of use to firemen in the conflagration and more could have been used were it not for their improper spacing. As will be noted in the diagram, page 84, most of these reservoirs were located in the uncongested southwestern part of the city. It was unfortunate that the only one in the center of the city was out of service, undergoing repairs at the time of the quake.

The Ashihane river was not of much use to fire fighters. Usually only one-third of its 450-470 foot wide river bed was covered by water, with the rest converted to vegetable fields. Of the several approaches that had been provided for pumpers, most were in poor repair and were not usable. The many houses that had been built along the banks contrary to regulations also blocked access to the river water.

The moat around the old Fukui castle was one of the few reliable sources of water in the conflagration and provided sufficient water to save the nearby group of municipal buildings.

In the past a system of drainage ditches that ran for the most part in conduits beneath the streets of the city had been a valuable fire protection aid. Water is ordinarily obtained from wooden manholes spaced at 150-300 foot intervals. In the 1948 conflagration, however, this source of water, for the most part, was not available, since the manholes were in bad repair.

Fire Department

Fire department personnel included the chief (mayor), deputy chief and 36 firemen. This force was supplemented by 300 volunteers divided into five working parties, also under the mayor. There is no record that these volunteers offered any organized assistance to the professional firemen during the conflagration, although it is assumed that they fought fire and rescued people in their own homes. This disinterest or lack of responsibility is typical of volunteer groups in those Japanese communities that also employ professional firemen.

Of the six pumpers (two with 670-gallon water tanks) and one tool carrier, one pumper and the tool carrier were out of service on the day of the earthquake. All

Fukui business district in June, 1945, showing destruction caused by incendiary bombing. The pictures on this and the following page were all taken from the same vantage point, the top of the 7-story fire-resistive store and office building shown on page 89.

Fukui business district in March, 1946, nine months later. The evidence of the air raid fire had not prevented the mushrooming of flimsy, combustible buildings all crammed into a single fire area.

Fukui business district on the last of June, 1948, after the disastrous earthquake and fire of June 28. The mushrooming process is starting all over again.

apparatus was housed in the city's only fire station, a one-story concrete structure (1800 sq. ft. area) located in the central part of the city. The telephone system was relied upon for alarm notification.

Earthquake and Fire

The late afternoon of June 28 was hot and sultry in Fukui. Temperatures were in the 80's and the barometer was dropping steadily. Due to an extended dry period a dangerous conflagration condition had existed for several days.

At 5:13 P.M. the first and most severe of 453 tremors recorded during the next five days shook the city and surrounding communities. Actually, the center of the quake was a few miles north of the city near the town of Harue, and 6.2 miles below the surface of the earth. Within seconds the city was one vast sea of confusion as people ran about in terror among collapsing buildings. An estimated 75 per cent of the city's buildings fell during these early minutes. The fortunate circumstance that stores and offices were closed was all that kept the casualty list from soaring above 3000 killed and 10,000 injured. Falling buildings were responsible for a majority of the casualties. Most of the estimated 1500 fire fatalities occurred when two wood frame moving picture theatres collapsed. Fire enveloped both structures before most of the thousands of occupants could extricate themselves.

Building damage as reported by the City of Fukui included 7387 totally, and 4925 partially destroyed. Of those completely destroyed, 2371 were burned. Wooden dwellings accounted for most of these totals, although several public buildings were destroyed. Among those burned were three office buildings, an armed forces barracks, a dormitory, six theatres of which four were wooden, and five wooden school buildings.

Because of the great confusion during the first few hours, certain details of the origin and spread of the fires must remain

unknown. Best available estimates indicate the outbreak of thirteen distinct fires either simultaneously with or immediately after the first severe tremor. It will be noted on the diagram, page 84, that six separate fires broke out in the congested area. It was these that bred the conflagration; the others in more sparsely built-up areas burned themselves out after destroying small clusters of buildings. Cooking stoves in the kitchens of dwellings or shops were responsible for twelve fires. One originating in a match shop is attributed to ignition of matches, and the fourteenth, discovered at 11:00 P.M. in a food warehouse, is believed to have been set.

Fire Department Operations

Immediately after the first earth tremor the officer on duty at the fire station dispatched a company with a tank truck to each of two fires he had discovered to the south and west. The fire to the south involved the Emori Paint Shop. After putting this out, the company continued on to a farm group in flames farther south. By using the rest of the water in the booster tank and 2800 gallons in a reservoir, this fire was halted in an hour's time after consuming three farm buildings. While here, word reached the crew that they were needed to save the fire station. On the return run it was noticed that the Emori Paint Shop, which "they had once been successful in putting out," was again in flames and beyond control. They did not stop.

The second company, on its way to fight fire in a macaroni shop in the western part of the city, stopped at the blazing ruins of two collapsed moving picture houses to help rescue trapped victims. While drafting water from an underground drainage ditch this company suddenly found itself surrounded by fire advancing from the south and west. Hose lines were abandoned as the crew jumped on their truck and drove back through choking smoke, collapsed buildings and fallen telephone poles to the fire station. Here the two original companies and other companies that had by now assembled did their best to save the city hall and other public buildings. Water in the old castle moat was used to good advantage in this stand.

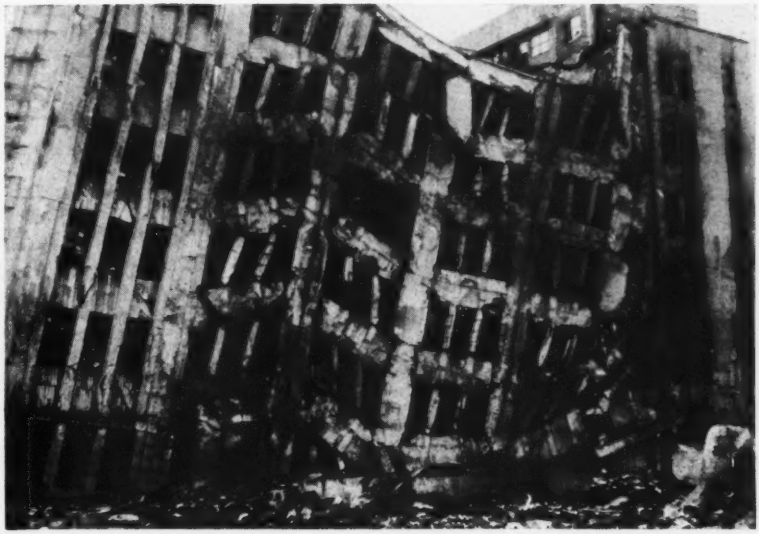
Memories of the citizens are vague as to the speed of fire spread through the congested city area. Despite an 11 mph southeast wind, best estimates indicate a speed of about 600 feet per hour toward the northwest in the early stages and gradual decrease to 250 feet per hour after five hours. In the meantime the citizens seemed to have regained their presence of mind and by concerted effort were able to bring the conflagration under control and succeeded in extinguishing it by daybreak. The fire had swept through 151 acres.

Reports are high in their praise of the professional firemen of Fukui, who left their families and collapsed houses to respond for duty. Typical is the case of Deputy Chief Taniguchi, who was at home with his family when the quake occurred. After dragging his wife and two babies from the debris, Chief Taniguchi hurried to the fire station to organize and direct fire fighting and rescue squads for three days and nights without rest.

Examples of Structural Damage

Examples are cited to indicate the effect of earthquake and fire on the various types of building construction in use in Fukui.

The 7-story fire-resistive (concrete protected steel frame) building on page 89 was occupied on the first two floors by the Daiwa Department Store and by offices above. This building suffered great earthquake damage, after which fire outside en-



After the earthquake inflicted severe structural damage on this 7-story fire-resistive store and office building, fire spread from an adjacent structure and burned out the interior. Of the few employees in the building when the quake occurred, all except one escaped safely down emergency exits.

tered and consumed everything within. Since the quake occurred after the store and offices had closed, only a few employees were caught in the building. Only one was unable to escape safely down emergency stairs.

Damage was especially severe in the 4-story fire-resistive Jinken warehouse. In this case also, fire in the neighborhood entered the building.

The Fukui Bank building is an excellent example of an otherwise structurally sound fire-resistive structure that burned because of a slight defect. The severe tremor had formed a slight opening around a fire door that permitted fire to enter and destroy the furnishings. The fire-resistive Hypothic Bank, on the other hand, came through the tremors without a crack. All fire doors and window shutters worked perfectly and no fire entered the building.

Unprotected steel frame buildings showed their weakness in many instances. One was the Shochiku Theatre. Fire in a neighboring building entered through a basement window, burned out the interior and collapsed the steel roof supports.

Sakaye Theatre, the only brick, wood-joisted public building in Fukui, crumbled with the first shock. Fortunately, the afternoon's performance had ended before the tremor.

The "dozo" warehouses, peculiar to Japan, are built of mud plastered on bamboo strips. These structures are supposed to protect the contents from exposure fires. Needless to say, the earthquake developed cracks in the construction through which exposure fires entered.

The Japanese classify wooden buildings with cement walls as semi-fire-resistive. These did not withstand the Fukui confla-

gration and most of them, including the two theatres where thousands were trapped, collapsed at the first tremor and were devoured by fire.

Conclusion

Investigators attribute this disastrous conflagration to ten principal factors.

1. Certain public buildings (moving picture theatres) were of combustible construction and not earthquake-proof.
2. City officials failed to enforce city planning regulations and building laws.
3. A majority of the buildings had straw or wood-shingle roofs.
4. Collapsed buildings blocked narrow streets.
5. Kitchen fires were being used to prepare evening meals at the time of the earthquake.
6. Oil and gasoline was secretly stored in many shops.
7. An extended dry period preceded the earthquake.
8. The fire department lacked adequate manpower and equipment.
9. Water mains were broken by the earth tremors.
10. The terror-stricken populace was unable to make a sane attack on the fire.

South St. Paul Stockyards Fire

On May 31, a small fire was discovered in a hay shed in the South St. Paul, Minn., stockyards. An inadequate water supply permitted the blaze to overpower early fire fighting efforts and spread with prairie-fire speed through fifty acres of combustible cattle pens and miscellaneous wooden structures.

The stockyards covered a roughly rectangular area three-quarters of a mile long and half a mile wide. Rows of cattle pen blocks comprised most of this space, each block being approximately 275 feet square and separated from its neighbors by 20-foot alleys. Wooden fences subdivided each block into 30-40 compartments. Numerous wooden hay barns, testing sheds, scale houses, inclined runways and other structures necessary for the feeding, resting and handling of animals were scattered among the blocks. Meat packing companies occupied property bounding three sides of the yard and a long roofed chute or shipping division, through which animals were transferred from freight cars to the pens, extended along the fourth. A large number of cattle cars were spotted on the siding adjacent to the shipping division.

Private protection consisted of a yard brigade with two booster pumps and central station supervised watchman service during night hours. Yard hydrants on long round-about runs of 6-, 8- and 10-inch mains were supplied by a 100,000-gallon elevated water tank. These mains also furnished a constant flow of water to the many open outlets in the water troughs of the pens.

During the Memorial Day holiday operations were virtually at a standstill. Watchman protection was not maintained during the daylight hours and only a few employees engaged in caring for stock and cleaning the pens were in the yard. An unusually large amount of tinder-dry refuse had accumulated in the pens during the period of the recently settled strike.

Acme.

Fire, relatively small when discovered in the South St. Paul stockyards, spread beyond control of firemen because of a weak private water system.

At 11:30 A.M. a passer-by called attention of a yard policeman to smoke issuing from a hay shed. The first of South St. Paul's three engine companies to reach the scene found a 10 ft. square fire burning in the open shed. Hydrants were not readily accessible. Firemen busy locating the nearest hydrant and running hose lines from it suddenly realized that flames had broken from the shed and completely surrounded them. By racing their engine through the fire the crew managed to reach safety. Calls for additional equipment were sent as the fast-spreading fire jumped from one to another of the tinder-dry pen blocks. Seven companies from St. Paul and five from the stockyards and near-by packing plants brought the total engines eventually mobilized to 15.

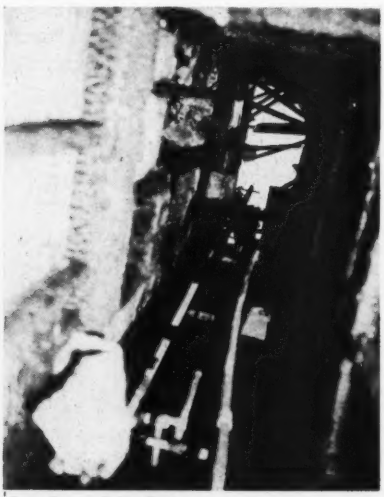
Lines were laid from yard hydrants, but early attempts to surround and confine the fire failed because of weak water supplies. Strategy was then changed and a retarding action was fought by wetting down and retreating when necessary. By this means, yard employees gained time to release over 2000 cattle, the only animals lost being 47 head trapped in pens near the fire's origin. Many cattle cars were also pulled to safety. Shifting breezes and showering sparks often threatened to surround fire crews in their attempts to slow the spreading flames, and in several instances hose lines had to be abandoned. Eleven hundred feet of hose were lost before ample water supplies could be obtained from yard hydrants of surrounding packing plants and from public street mains. Once sufficient water was at hand a stand could be made and the blaze extinguished.

A survey of the damage revealed destruction of 11 blocks of pens, three hay barns containing 30,000 tons of hay, 140,000 sq. ft. of the roofed-over "chute," and 88 cattle cars on exposed sidings. A total loss estimate of $1,150,000 includes $750,000 damage to the stockyards and $400,000 to railroad rolling stock.

Santa Monica Hotel Fire

A fast spreading fire in the attic above the north wing of the Del Mar Hotel and Beach Club confronted Santa Monica firemen when summoned by a hotel employee at 1:24 P.M., July 11. Flames soon entered the eight non-firestopped, exposed wood lath service shafts in this wing and spread down through the 6-story structure. Only the dogged tenacity of the Santa Monica and Los Angeles firemen confined the flames to these shafts and prevented lateral spread through the lower floors.

The brick, plank on timber hotel fronting on the ocean was U-shaped above the third story, an open area on the ocean side separating the north and south wings. Elevators and stairways were not enclosed, the building having been constructed before such protection was required. Fortunately for the hundred occupants of the building, the fire did not occur at night, and started above them so that they were able to escape down the open stairs when ordered to leave by the fire chief. Topping the structure was a large undivided attic containing three handball courts which in recent years had been used as a storage area for discarded furniture and old office records. The attic also housed exhaust system equipment. This system, the only mechanical ventilation in the building, conducted air via metal ducts from the lavatories, as required by law. It was not a factor in the fire.



Santa Monica Police Dept.

One of eight exposed wood lath service shafts in the north wing of the Del Mar Hotel down which an attic fire spread to lower floors.

Standpipes, soda-acid extinguishers, and auxiliary fire alarm boxes were installed for the hotel's protection. It will be noted that each relied on employee training for effective operation — training which was grossly inadequate in the case of the Del Mar employees, if their behavior following discovery of the fire is a criterion. Neither automatic sprinklers nor automatic fire detection were provided.

At 1:09 P.M. a housemaid in a sixth floor room in the north wing suspected the presence of fire in the attic above and notified the desk. The fire department was not called. Instead, the house engineer was dispatched to the attic, where he discharged three soda-acid extinguishers. When this action failed to check the spread of flames, the switchboard operator was told to notify the fire department, fifteen minutes after the fire was discovered.

A second alarm and several special calls were sent by first alarm companies, who were confronted with the task of getting large volumes of water on the raging fire seven stories above the ground before it could spread to the rest of the attic or to

lower floors. Flames were already burning down through the eight combustible service shafts in the north wing. The four engine companies and one ladder truck from Santa Monica were supplemented by three engines, two ladders and a salvage company from Los Angeles. Responding time for the Los Angeles companies averaged 35 minutes.

The fire was attacked from within on three fronts. Lines dragged up over stairways or laid from exterior standpipes were discharged on the fire from that part of the attic as yet not involved. Others were directed up attic stairways and through the sixth floor ceiling directly beneath the fire. Ten 1½-inch lines from interior standpipes, constituting a vital third line of defense, were being used on the three top floors to extinguish flames breaking through from the service shafts.

This was the status until sections of the sloping tile roof collapsed early in the fire. Firemen in the attic were able to hold their positions and prevented further lateral spread. Companies directly beneath the fire, however, were forced to retreat from their sixth floor position, and those operating the standpipe lines were robbed of their water supply when a falling roof section

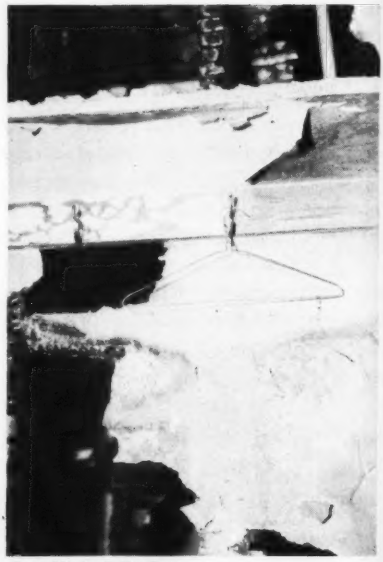
Acme.

During fire in the attic of the 6-story Del Mar Hotel, the sloping tile roof collapsed. Firemen on ladders and in the street were endangered by overhanging sections that fell to the ground at intervals.

broke an interior standpipe. Perhaps the most serious hazard introduced by the collapsing roof was to men on ladders and in the street as overhanging roof sections hurtled to the ground at frequent intervals.

Despite disruption of fire fighting strategy caused by the roof collapse, the fire was successfully confined. Fire streams were brought down from the sixth floor to replace the broken standpipe lines. The numerous small fires that broke out on the fifth and fourth floors were subdued with minor damage, and the flames within the service shafts were gradually brought under control. Ladder pipes effectively cooled the attic area of the north wing as well as that section of the sixth floor directly below to which fire had spread. By 4:30 P.M. the flames were under control.

Cause of the fire had not been determined, although examination of char indicates that it probably originated in a small closet.



Santa Monica Police Dept.

Fifth floor room of Del Mar Hotel. Typical of burn through from service shafts.

The salvage company from Los Angeles spread covers and in other ways kept water and smoke damage on lower floors at a minimum. This company was credited with preventing thousands of dollars in smoke and water damage to furnishings. Preliminary reports indicate $330,000 damage to the building, $70,000 to the contents, and $30,000 to personal effects of guests. Total estimated loss $430,000.

Fire Does Not Wait for Sprinklers

Waste Paper Warehouse Fire, Monroe, Michigan

Sprinkler installations should be completed and the system placed in operation before combustible contents are permitted in newly erected "sprinklered" buildings. The wisdom of this precaution was emphasized on May 16, 1948, at Monroe, Mich., when fire destroyed a newly built noncombustible warehouse loaded with baled waste paper.

In January work had been started on a new 36-foot high one-story addition to the paper box factory of the Monroe Paper Products Company. Construction was to be noncombustible throughout and called for concrete floors, brick apron walls, steel framed glass windows and a pre-cast concrete slab roof on unprotected steel frames and girders. Plans also called for complete sprinkler protection for the undivided 30,000 sq. ft. addition. So that the factory's production would be interfered with as little as possible, the new section was

built around and over a small sprinkler protected wooden building it was to replace.

Early in May, construction was nearly completed and razing of the old wooden building inside was under way. As yet, however, the sprinkler installation had not been completed. Notwithstanding this lack of fire protection it was decided to occupy the addition at once, and May 16 found a large area occupied for the storage of baled waste paper and lamp black. The breaker end of a beater machine was also set up and in operation.

Shortly before 9:00 P.M. the foreman left the beater room in the new addition to inspect other parts of the plant. Returning a few minutes later he found fire spreading rapidly over loose and baled waste paper in the storage area. After summoning employees to help close two fire doors in the fire wall separating the addition from the main factory, he telephoned the fire department. Although the two engines and one ladder truck were hindered somewhat in their response by congested traffic and a blocked railroad crossing, this delay was not a vital factor in the fire since the heat-weakened unprotected steel roof supports collapsed and dropped the roof into the fire minutes after their arrival. An additional engine company was summoned and ten hose lines were eventually brought into play to extinguish small fires in yard-stored baled paper and to protect exposures. Operation of six sprinklers opposite small unprotected pipe openings in the fire wall was of material assistance in preventing spread to the main factory.

Cause of the fire remains undetermined.

A. E. Jones.

This new noncombustible building in Monroe, Mich., was occupied for the storage of waste paper before the sprinkler installation had been completed.

Possibilities include a lightning strike and spontaneous ignition of lamp black. Whatever the cause, failure to complete the sprinkler installation allowed fire to develop undetected and to spread beyond control before discovery. Loss is estimated at $300,000.

Hexane Explosion, Seattle

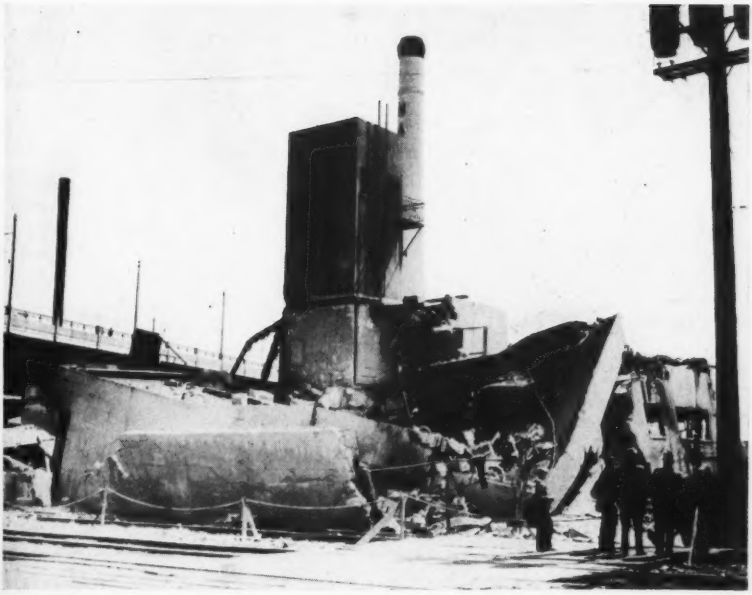
The Lyle Branchflower Co. of Seattle, Wash., processes halibut livers and other fish and meat products to obtain high vitamin content oil. On July 6, explosion of flammable vapors (reportedly hexane, flash point –15°F) escaping from an extraction vessel took the lives of the four employees in the processing building and reduced most of the structure to a mass of rubble. This disaster emphasizes three well-known principles: (1) that hazardous processes should be safeguarded against faulty manipulation of equipment, (2) that adequate ventilation should be provided for all areas where flammable vapors may be present, and (3) that explosion venting in the form of windows, skylights or light wall construction should be provided wherever there is a vapor explosion hazard.

Frank Jacobs.

This picture shows the open charging dome of a cooker in the debris of a Seattle fish oil extraction plant. When employees neglected to close the cover before heating a solvent-oil mixture, escaping flammable vapors rapidly filled the building and exploded.

The one- and two-story processing building was constructed of reinforced concrete with exterior walls eight inches thick. A fire wall divided the structure into two sections, referred to hereafter as the east and west sections. Laboratories, offices, an elevator shaft that served both sections, and equipment for oil extraction by mechanical and chemical means (no solvent used) were located in the west section. The east section housed most of the apparatus for a separate and distinct process of extraction, using a flammable solvent as the extracting agent. Fire wall openings, including those in the elevator shaft, were protected by sliding tin-clad fire doors. In this instance the fire doors were not sufficiently tight to be an effective barrier against the passage of flammable vapors.

The solvent extraction process in the east section was responsible for the explosion. Apparatus consisted of two steam jacketed cookers each eight feet in diameter and fourteen feet long located in the basement cooker room. Charging domes twelve inches in diameter surmounted the cookers and extended through the basement ceiling to the charging floor above. These domes were closed by covers manipulated on the charging floor. The position of these covers was not visible from the operating



Frank Jacobs.

The wreckage of this fish oil extraction plant in Seattle, Wash., is an example of the destruction that explosion of flammable vapor-air mixtures can cause.

floor below. Raw material is supplied from a mill on the second floor of the west section through an unprotected fire wall opening beneath the mill. Briefly, the process consisted of introducing a charge of raw material through the dome, driving off moisture and then washing the dry residue with solvent. The oil-rich solvent was transferred by pipe to the second cooker, where the solvent was vaporized and reclaimed by a condenser on the roof. The explosion occurred during this final separation of solvent from oil.

From the effects of the extremely violent explosion in various parts of the building on both sides of the fire wall, it is evident that a large volume of flammable vapor must have been discharged within the structure in the few minutes prior to the explosion. Vapors spread horizontally around fire doors and through the unprotected opening beneath the mill, and vertically through the elevator shaft. Testimony of day-shift employees that the dome cover was off at 5:00 P.M., 32 minutes before the explosion, and evidence found in the rubble indicate that the vapor source was the open dome of the second cooker. Investigation of the debris revealed a quantity of solvent in this cooker, the steam valves to its jacket in the "on" position, and the dome cover off. Further, plant records showed a solvent separation scheduled for the night crew. Apparently no one had gone to the charging floor to check the position of the dome cover before commencing the distillation. That the employees in the cooker room did not notice the odor of escaping solvent is explained by the fact that an effective exhaust

system was in operation in the basement cooker room. Neither the charging floor nor other parts of the building were protected.

The source of ignition is not known. Possibilities include ordinary induction motors operating in the west section, or gas burners in a chemical laboratory. Although the fire department was summoned promptly by a passer-by, the ensuing fire was difficult to control due to the large volume of flammable liquids escaping from ruptured pipes.

Preliminary estimates set the loss to the building at $200,000, and to machinery and equipment at $250,000. Total $450,000.

Soybean Mill Fire, West Memphis

Soybean mill fires are usually associated with escape of flammable solvents or spontaneous heating of soybean oil. Destruction of the main mill of the Arkansas Mills, Inc., at West Memphis, Ark., on May 7 did not involve either of these hazards, but did emphasize other hazardous conditions that must be given consideration if the record of this occupancy is to improve.

This moderate-sized crude soybean mill was a high one-story wood-joisted structure with concrete floors, mostly wooden siding (some ironclad sections) and composition on metal roofing. The numerous adjoining and communicating additions enlarged the undivided fire area of the mill to 25,317 sq. ft. The three wooden soybean storage bins that occupied about half the mill building extended 49 feet to the peak of the roof. Other buildings exposed by the main mill included 16 reinforced concrete grain tanks, an all-steel cracking mill, an ironclad unloader shed, two steel soybean oil tanks and a molasses tank.

Private protection consisted of one hydrant tied in to a six- and eight-inch circulating city main by a 2700-ft. long three-inch pipe. A 30-gallon wheeled type extinguisher and several hand extinguishers were distributed throughout the mill. Many of the latter were found to be empty during an inspection of the plant in 1947. A night watchman made hourly tours through the premises.

When working at capacity the mill processed 20 tons of soybeans per 24-hour day. Oil is separated from the bean by the so-called expeller process, which does not require the use of flammable solvents. Seeds are crushed by corrugated rolls, the small pieces passed through a steam cooker and thence to screw compressors, where the oil is expelled. The oil is pumped from a settling tank to outdoor storage tanks, and the residue is ground, sacked and loaded into waiting freight cars.

On the night of the fire the mill was being operated by three employees. A watchman patrolled the premises. A truck driver who had delivered a load of soybeans at 10:30 P.M. was asleep in his truck in the driveway. Shortly before 2:00 A.M. the watchman turned off the conveyor motor in the soybean bin area and proceeded on his tour through the building. He reported that he noticed no irregularity. At 2:10 A.M., a West Memphis policeman discovered fire in the mill when he went to investigate the excited barking of a dog. Flames were coming from an area close to the roof in the soybean storage section. The telephone operator was notified to sound the town's fire siren. The watch-

N. Adams.

A large amount of dust and refuse had been allowed to accumulate in this soybean oil plant. When fire broke out it spread with semi-explosive speed through the dusty undivided structure.

man in the meantime had completed his two o'clock round and was passing through the driveway when he too discovered smoke pouring from the vicinity of the soybean bins. He immediately ran to the office and kicked open the locked door but was unable to enter to telephone the alarm because of the intense heat. On the way to an all-night service station, 400 feet away, he met the first fire department pumper responding to the alarm.

Fire spread was so rapid that the employees had to vacate the mill without rescuing their personal belongings from the lockers, and the truck driver in the driveway just managed to back his truck from the mill before flames enveloped the area. Although no true explosion shock wave was described by witnesses, they state that the fire rushed through the building with what seemed to be a roar. Employees brought the hose attached to the private hydrant into play but were shortly compelled to drop it because of the heat. Volunteer firemen attached their two pumpers to hydrants 50 and 400 feet away from the building and supplied a total of three 2½-inch lines. They had adequate water for the small nozzles being used, but the fire made such headway that efforts were confined to the protection of exposed structures. The fire had practically burned itself out at 11:00 A.M., when hose lines were shut down to conserve the small amount of water remaining in the town's elevated tank.

There is general agreement that fire originated in the section of the mill housing the soybean storage bins. In this area there were two seed elevators and a screw type conveyor. It is believed that the fire originated in an overloaded electric motor powering a choked down screw conveyor. The motors were not approved for atmospheres containing grain dust. The possibility of a dust explosion causing the in-

cipient fire is remote because all conveyors in the area in which the fire is believed to have originated had been shut down for about 30 minutes before the fire was discovered. A more probable theory suggests that the fire in the motor, upon reaching suitable magnitude, caused sufficient draft to stir up an air-dust mixture by means of which the fire spread through the seed storage area at semi-explosive speed. The handling of soybeans is an extremely dusty process, and it is evident from statements of employees that inadequate housekeeping methods had permitted a vast amount of refuse and dust to accumulate.

Although damage to the building and stock was nearly total and is estimated at $194,000 and $76,000 respectively (total $270,000), exposed tanks and buildings suffered slight, if any, damage.

Louisville Refinery Fire

At 1:18 A.M. on June 26, a steel storage tank containing unblended natural gasoline exploded at the Ætna Oil Company's refinery at Louisville, Kentucky. When the ensuing fire was extinguished 39 hours later, 29 petroleum products storage tanks had been destroyed with an estimated loss of $250,000.

The three principal buildings at the refinery were a cracking plant, topping plant, and boiler house. These were on the northern boundary of the property. To the south and up a slight grade, there were 85 steel storage tanks, ranging in capacity from 200 to 6000 barrels. Earthen dikes segregated these tanks into groups, the largest diked group comprising 25 tanks.

Unblended natural gasoline was stored in a welded steel, individually diked 252,000-gallon spheroid tank. The tank was provided with a 6-inch nozzle (with flame arrester) to which was connected a two-way discharge relief valve with openings each four inches in diameter. These weight-loaded relief valves were set to operate at 15 lbs. pressure or 1 oz. vacuum.

Shortly before 1:00 A.M. an employee opened a gate valve near the base of this tank. Investigation has since revealed that he had inadvertently opened the wrong valve and thereby allowed gasoline to escape through an uncapped line that terminated just beneath the surface of the ground. Following the flood of 1937 in which the tank floated from its foundation and broke connections to two underground pipes, it was decided to discontinue the use of one of them. Neither employees nor the management were aware that the discontinued line had been left uncapped. Vapors exuding from the gasoline-saturated ground at the base of the tank were carried by a southwest wind over the ground in the direction of the topping plant and boiler house 500 feet to the north. It is believed that the vapors ignited at one or the other of these plants, although ordinary electrical equipment in the path of the vapors may have been the cause. Fire flashed back to the gasoline flowing from the ground around the tank and, after a period of 20 minutes during which its contents were gradually heated, the tank blew apart and threw sections into a diked area 100 ft. away, where 25 other storage tanks were grouped. Flames punctuated by explosions quickly involved all the tanks within this dike and also two adjacent in-

Note: This account is based upon information from the Louisville Fire Department and from the Kentucky Inspection Bureau, with observations on tank venting by the Editor.

dividually diked tanks. Whether the ignition of the various tanks was the result of impact by flying debris from the spheroid tank which exploded, or whether due to heat exposure from burning gasoline was not reported, nor is there any information as to the exact construction and venting facilities of the 27 tanks. The severity of the fire, however, was obviously so great that the complete destruction of these tanks, once ignited, was inevitable despite the best efforts of the fire department.

Fire fighting was a long and arduous job. The steam smothering system with which all tanks except the spheroid (to which such a system would not have been applicable) had been equipped had been disrupted by the first explosion; in view of the known limitations of steam there is no reason to believe that the steam system would have been of any material value even if the piping had been intact. The public fire department was on the scene within minutes, and immediately laid lines from public and private hydrants. Eventually 14 large hose streams were placed in use to cool burning tanks, throw up water curtains between the tanks and equipment, and to cool the cracking and topping units. These cooling operations were successful in preventing involvement of the buildings or more tanks. By the second day the fierce intensity of the fires had relaxed sufficiently to allow firemen to move in with hand lines to complete the extinguishment of most of the fires.

Hose streams were the principal but not the only means of fire control used. Following the initial blast, plant pumps were put in operation to remove as much as possible of the contents from the burning tanks. Earth was thrown up around ex-

Acme.

Discharge of gasoline from a storage tank through a disconnected but uncapped pipe was the cause of fires and explosions that destroyed 29 storage tanks at Louisville, June 28. Vapors ignited at a refinery building 500 feet distant.

posed heated valves and piping at the base of tanks to prevent breaking by too rapid cooling. Dirt was also used to absorb leaking gasoline. Two tank fires were extinguished by foam, and nine by carbon dioxide and dry chemical. Whether the extinguishing agent was water, carbon dioxide, dry chemical, or foam, in all instances destruction was practically total before extinguishment was effected. In all, 645 pounds of carbon dioxide, 5000 pounds of foam, and 870 pounds of dry chemical were used.

An interesting feature of this fire related by the Louisville Fire Department concerns the difficulties it met in extinguishing fire in tank No. 54, the last to remain burning. This tank contained natural gasoline of low volatility. An attempt was made to use 600 pounds of carbon dioxide, but application with the discharge valves opened wide caused the flames to leap to an adjoining tank. After the discharge valves were partially closed, the rest of the gas was discharged, but results were not satisfactory. Dry chemical was next used, and with the use of two 300 lb. units the fire was put out. An ingenious method was devised to discharge the dry chemical on the fire. Two sections of an extension ladder were spliced together and dry chemical discharge nozzles tied to one end. Eight men raised the ladder and, with the assistance of four guide ropes, each manned by four men, the ladder was manipulated as a portable tower and the fire extinguished.

The initial explosion of the spheroid tank, which was the major factor in this fire, cannot be definitely explained on the basis of the available data. In the absence of any NFPA standards specifically applicable to spherical gasoline tanks, there is no basis for determination of whether the pressure relief vent was of size adequate to prevent the failure of the tank from internal pressure due to heating of the contents. However, assuming that the tank was properly designed for a 15 psi working pressure, with a reasonable factor of safety, it would appear on the basis of NFPA standards for cylindrical tanks that failure should not have occurred from internal pressure if the pressure relief valves were operating properly and provided unobstructed discharge area in accordance with their nominal size. NFPA standards for tank vents are based upon a heat input of 6000 Btu per hour per sq. ft. of vented tank surface under fire exposure conditions. NFPA standards for water spray protection are based upon an assumed maximum of 20,000 Btu per hour, but even calculated on the 20,000 Btu basis it is not clear that the vent area in this case was sufficiently small to explain a pressure rupture within 20 minutes. The remaining hypotheses to explain the explosion would be that the vents may not have been operating properly, that they were obstructed or were of such design as to provide a fire discharge area only a fraction of their nominal size, or that the tank itself was defective either due to some fault in its original design or construction or due to some injury it may have sustained when floated in the 1937 flood. Spheroid tanks, designed to operate under pressure, present a greater potential hazard than ordinary atmospheric pressure storage tanks for flammable liquids because of the greater potential release of energy in case of failure. They present a difficult problem in inspection, as the fire inspector usually has no convenient criterion for determining whether the design and construction are proper or whether the pressure venting facilities are adequate.

Fires and Fire Losses Classified, 1947

There were approximately 538,000 building fires in the United States in 1947 causing $703,000,000 damage, according to estimates compiled by the National Fire Protection Association. An additional 1,104,000 fires not involving buildings—aircraft, motor vehicle, forest, ship, rubbish, grass fires, etc. — accounted for an estimated $72,700,000 loss, and increased the number of fires of all types in the United States in 1947 to 1,642,000. The total loss was approximately $775,700,000. Comparative over-all estimates of 1946 fire experience were not published. Building fire estimates for 1946, reported in the October 1947 *Quarterly*, showed 528,000 fires with loss of $569,300,000.

The data from which Tables I to IV were compiled were obtained from sixteen state fire marshals' reports for the year 1947 or the closest fiscal year thereto. Reports of these particular states were chosen because they contained the most complete classifications of cause and occupancy data. While the methods of reporting and tabulating fire loss figures differ from state to state, the volume of statistics from these sixteen typical states, representing all sections of the country, and including both primarily agricultural and industrial states, is sufficiently large to indicate the relative distribution of fires and fire losses. Table I shows the number of fires by occupancy in fourteen states and Table II the loss by occupancy in thirteen states. Tables III and IV list the number of fires and loss by cause in sixteen and fourteen states respectively. Table V summarizes loss statistics of all states that have furnished data to the NFPA.

Tables VI and VII, showing the nationwide distribution of fires and losses by occupancy and cause, are based primarily on typical state experience enumerated in Tables I to IV. Table VI has been revised and expanded. Sufficient data have been forthcoming to permit the addition of "Textile Workers" and "Printing" to the list of building occupancies. Group VI—Other than building fires—has been introduced to emphasize a significant portion of the nation's fire waste. Various sources have furnished figures for the individual items in the group. Statistics on aircraft fires were compiled by the NFPA Committee on Aviation and Airport Fire Protection. Motor vehicle data are based on a recent survey of 457 U. S. cities (Fire Record of Cities, April 1948 *Quarterly*). This survey suggested the advisability of substantial upward revision of previous estimates of the number of motor vehicle fires. Forest fire estimates are those compiled and published by the Forest Service of the U. S. Department of Agriculture. Results of the recent survey of U. S. cities were also the basis for an estimate of the number of rubbish, grass and brush fires. It is not customary to attach a dollar value to the relatively insignificant property damage inflicted by these fires. However, the cost of extinguishment of this tremendous number of fires (estimated 690,000) represented a major percentage of the nation's 1947 fire bill.

As will be seen in Table V, the sixteen states with a population of 47,001,599 reported a total of 151,661 fires. Experience indicates that this is somewhat under half the actual number of fires. Many states,

Table I. Number of Fires by Occupancies in Fourteen States — 1947

Occupancy	Connecticut[1]	Illinois[1]	Indiana[2]	Iowa	Kansas	Louisiana	Massachusetts[3,4]	Nebraska	Ohio	Oklahoma	Oregon[5]	South Dakota[6]	Vermont[5]	West Virginia	Total
I. Public Buildings															
Government buildings	4	....	10	....	....	....	14	1	....	....	19	5	3	7	63
Hospitals, institutions	....	95	2	5	5	25*f*	13	....	34	....	....	1	....	....	110
Schools and colleges	20	63	12	15	18	30	30	12	60	15	36	7	14	9	341
Churches	11	75	31	17	16	19	26	19	81	8	38	....	9	6	356
Theatres, including motion pictures	3	26	11	9	9	43	2	5	59	8	13	8	1	5	202
Amusements, halls	10	62	25	21	....	....	6*g*	....	113	....	....	16	5	5	322
II. Dwellings															
Hotels, boarding houses	27	255	38	43	28	355*g*	95	24	267	....	428	7	11	57	1,635
Apartments, rooming houses	120	2,711	117	153	....	....	....	72	1,738	192	....	19	2	7	5,131
Dwellings	1,073	5,164	2,482	1,644	1,268	2,779	3,784	713	9,214	1,425	6,971*i*	387	613	381	37,898
III. Mercantile															
Offices and multiple mercantiles	21	164	32	55	33	161	56	27	985	91	....	12	11	19	1,667
Restaurants, taverns	51	407	80	93	....	....	113	72	....	128	186	31*m*	3	16	1,180
Miscellaneous mercantiles	156	1,411	582	180	394	100	567	106	1,251	369	651	82*n*	116	105	6,070
Warehouses	38	162	58	118	....	14	134	24	262	183	49*k*	....	19	21	1,082
IV. Manufacturing															
Metal workers	13	24	16	7	17	1	23	....	....	....	31	....	4	....	136
Woodworkers	6	6	22*a*	....	1	34	18	....	....	....	....	....	27	12	126
Flour mills, elevators	....	73	7*b*	21	22	1	....	17	....	....	27	4	1	....	173
Packing plants	....	19	4	15	....	....	....	4	....	....	10	2	....	3	57
Bakeries	3	34	5	11	....	....	12	....	....	....	12	....	1	1	79
Textile workers	4	....	....	174	4	50	9	....	....	5	31	....	8	....	285
Printing	4	6	9	5	....	....	12	....	....	....	10	1	2	1	50
Laundries	4	57	15	8	13*c*	....	16	3	51	....	24*c*	5	2	2	200
Cleaners, tailors	8	51	16	17	....	....	20	....	55	15	....	2	4	6	194
Misc. manufacturing	78	583	124	82	21	395	313	83	1,176	102	95	14	22	32	3,120
V. Miscellaneous															
Barns	165	355	214	146	398*d*	208*h*	147	183	360	282	268*l*	79	396*h*	20	3,221
Outbuildings	2	989	302	356	....	....	152	83	606	759	....	8	....	14	3,271
Lumber and coal yards	1	64	....	6	6	21	34	20	61	....	154	2	....	....	369
Railroad, wharf property	....	30	14	54	23	....	12	7	....	....	....	9	....	....	149
Bulk oil storage, refineries	....	7	1	....	....	33	....	....	....	....	30	2	....	....	73
Garages, filling stations	170	1,262	298	107	29*e*	106*e*	268	151	1,214	519	91	66	20	36	4,337
Power plants, pump houses	4	9	33	7	....	1	22	4	....	....	....	7	....	....	87
Creameries, dairies	....	....	1	14	....	....	....	7	....	....	13	....	3	....	38
Miscellaneous structures	80	493	314	....	45	72	64	26	1,003	545	....	14	9	20	2,685
Motor vehicles	199	2,607	421	628	285	499	676	234	4,675	....	486	160	....	54	10,924
Fires other than buildings	7	121	73	21	2	4	15	80	....	1,346	....	42	....	2	1,713
Hangars and contents	....	....	1	....	....	....	....	....	....	....	....	....	1	1	3
Total	2,282	17,315	5,368	4,032	2,637	4,951	6,714	1,977	23,265	5,992	9,673	992	1,307	842	87,347

[1] Fiscal year ends June 30, 1947.
[2] Fiscal year ends May 31, 1947.
[3] Does not include Boston.
[4] Includes only fires with loss.
[5] Insured claims only.
[6] Fiscal year ends June 30, 1948.
a. Includes lumber yards.
b. Includes coal elevators.
c. Includes cleaners, tailors.
d. Includes rural dwellings.
e. Includes airplane hangars.
f. Includes government buildings.
g. Includes amusements, halls.
h. Includes all farm property.
i. Includes apartment, rooming houses.
j. Includes office buildings.
k. Includes railroad property.
l. Includes outbuildings.
m. Includes hotels, boarding houses.
n. Includes warehouses.

[1]Insured claims only.
[2]Fiscal year ends June 30, 1948.
a. Includes lumber yards.
f. Includes government buildings.
g. Includes amusements, halls.
h. Includes all farm property.
m. Includes hotels, boarding houses.
n. Includes warehouses.

Table II. Fire Losses by Occupancies in Thirteen States — 1947

Occupancy	Connecticut[1]	Illinois[1,2]	Indiana[3]	Iowa	Kansas	Louisiana	Massachusetts[4,5]	Nebraska	Ohio	Oregon[6]	South Dakota[7]	Vermont[6]	West Virginia	Total
I. PUBLIC BUILDINGS														
Government buildings...	$56,375	.....	$75,440	.....	.....	.....	$22,447	$175	.....	$13,371	$6,775	$579	$29,250	$204,412
Hospitals, institutions...	.....	$16,570	283	$499	$1,281	$119,162*f*	30,080	.....	$9,707	.....	250	.....	.....	177,832
Schools and colleges....	138,825	246,325	110,225	204,418	37,225	113,361	164,890	12,285	49,296	98,792	132,774	21,445	113,800	1,443,961
Churches	91,201	425,575	108,231	186,800	91,540	58,143	132,764	156,076	479,082	74,030	.....	5,204	25,085	1,833,731
Theatres	34,423	69,205	316,941	20,235	96,170	216,942	4,475	33,386	164,460	42,711	57,695	1,602	57,365	1,115,610
Amusements, halls.....	56,386	311,832	613,110	135,159	.....	.....	585,507	.....	410,064	.....	53,243	19,804	25,150	2,210,255
II. DWELLINGS														
Hotels, boarding houses	29,420	239,281	73,594	30,523	20,968	314,662*g*	242,774	2,620	116,814	345,758	16,347	8,158	220,750	1,661,669
Apartments, rooming houses	131,727	324,903	134,955	110,477	.....	.....	.....	72,038	870,215	.....	23,012	1,576	7,190	1,676,063
Dwellings	1,644,968	3,625,577	4,813,928	1,541,955	595,779	1,931,213	4,406,163	623,209	4,487,700	2,542,447*i*	238,016	355,877	1,070,611	27,877,443
III. MERCANTILE														
Offices and multiple mercantiles	59,643	444,664	898,002	169,060	58,817	328,796	270,373	87,773	1,799,211	.....	21,636	17,178	86,300	4,241,453
Restaurants, taverns...	286,395	545,636	137,328	179,347	.....	.....	505,914	219,324	.....	111,965	17,720*m*	30,639	66,135	2,100,403
Misc. mercantiles	439,069	1,739,570	2,786,769	627,345	780,755	237,945	1,194,003	1,135,389	1,951,098	1,140,389*j*	235,284*n*	368,940	955,357	13,631,913
Warehouses	248,479	3,081,139	778,644	1,380,502	.....	8,496	518,124	283,320	814,327	275,623*k*	.....	77,472	75,575	7,541,701
IV. MANUFACTURING														
Metal workers	40,582	276,000	133,678	1,899	45,123	100	108,067	.....	.....	57,325	.....	456,360	.....	1,119,134
Woodworkers	27,300	23,825	122,122*a*	.....	250	404,569	52,396	.....	.....	.....	.....	272,085	315,320	1,217,867
Flour mills, elevators...	.....	2,207,499	104,265*b*	401,190	546,708	102	.....	251,691	.....	1,424,427	10,415	36,256	.....	4,982,553
Packing plants.....	.....	7,520	16,661	23,190	.....	.....	.....	40,165	.....	65,873	9,000	.....	21,575	183,984
Bakeries	7,794	13,045	7,113	60,929	.....	.....	19,355	.....	.....	13,694	.....	563	50	122,543
Textile workers.....	222,416	.....	.....	185,942	91,950	88,523	40,645	.....	.....	7,111	.....	51,320	.....	687,907
Printing	683	350	11,517	30,550	.....	.....	19,014	.....	.....	45,070	200	8,673	20,000	136,057
Laundries	2,812	36,848	138,959	202,510	31,676*c*	.....	16,355	20,280	165,538	52,622*c*	1,375	18,707	2,400	690,082
Cleaners, tailors.....	30,455	186,270	16,641	24,051	.....	.....	25,660	.....	154,511	.....	415	18,844	18,375	475,222
Misc. manufacturing....	445,246	1,784,041	1,948,839	911,954	128,847	2,231,297	2,441,857	235,914	6,550,990	523,949	113,142	167,500	777,914	18,261,490
V. MISCELLANEOUS														
Barns	411,939	1,027,811	900,367	679,974	799,757*d*	513,480*h*	517,539	304,595	1,345,958	418,858*l*	142,807	780,487*h*	102,950	7,946,522
Outbuildings	942	253,659	743,092	279,785	.....	.....	84,522	63,564	175,221	.....	2,538	.....	28,310	1,631,633
Lumber and coal yards.	250	623,411	.....	36,625	4,126	88,282	362,330	131,171	121,382	1,042,936	110	.....	.....	2,410,623
Railroad, wharf property	.....	1,266	172,638	39,704	28,735	.....	21,211	9,335	.....	.....	4,531	.....	.....	277,420
Oil storage, refineries...	.....	603,500	1,100	.....	.....	99,146	.....	.....	.....	44,857	12,800	.....	.....	761,403
Garages, filling stations	311,891	558,441	2,016,065	259,002	48,786*e*	86,444*e*	328,002	123,230	990,065	114,795	59,580	29,789	81,382	5,007,472
Power plants, pump houses	16,500	2,860	5,078	410,610	.....	67	46,312	16,500	.....	.....	3,475	.....	.....	501,402
Creameries, dairies.....	.....	.....	800	77,890	.....	.....	.....	3,906	.....	62,462	.....	704	.....	145,762
Miscellaneous structures	378,575	246,744	123,564	.....	322,501	249,948	200,499	15,328	1,409,595	.....	4,258	3,260	504,175	3,458,447
Motor vehicles.....	55,401	311,694	90,107	82,395	80,862	368,518	140,697	110,046	540,917	115,858	22,236	.....	67,234	1,985,965
Fires other than buildings	5,195	16,569	24,383	2,583	5,000	1,941	30,033	38,507	.....	.....	22,014	.....	14,000	160,225
Hangars and contents..	.....	.....	15,000	.....	.....	.....	.....	.....	.....	.....	.....	1,623	100,000	116,623
Total.....	$5,174,892	$19,251,630	$17,439,439	$8,297,073	$3,816,856	$7,461,137	$12,532,008	$3,989,827	$22,606,451	$8,634,923	$1,211,648	$2,754,645	$4,826,250	$117,996,782

[1]Fiscal year ends June 30, 1947.
[2]Does not include Chicago.
[3]Fiscal year ends May 31, 1947.
[4]Does not include Boston.
[5]Includes only fires with loss.
[6]Insured losses only.
[7]Fiscal year ends June 30, 1948.

Note: Classifications indicated include: (*a*) lumber yards, (*b*) coal elevators, (*c*) cleaners, tailors, (*d*) rural dwellings, (*e*) airplane hangars, (*f*) government buildings, (*g*) amusements, halls, (*h*) all farm property, (*i*) apartment, rooming houses, (*j*) office buildings, (*k*) railroad property, (*l*) outbuildings, (*m*) hotels, (*n*) warehouses.

Table III. Number of Fires by Causes in Sixteen States — 1947

Causes	Connecticut[1]	Illinois[1]	Indiana[4]	Iowa	Kansas	Louisiana	Massachusetts[2]	Michigan	Nebraska	Ohio	Oklahoma	Oregon[5]	South Dakota[3]	Vermont[5]	West Virginia	Wisconsin	Total
Chimneys, flues—defective or overheated	130	945	396	210	121	155	421	2,079	96	1,369	165	844	85	117	44	1,184	8,361
Sparks on roof	44	737	459	345	82	38	93	1,833	....	1,473	14	345	....	4	....	697	6,164
Defective or overheated heating equipment	297	1,580	501	334	157	621	538	3,877	315	2,095	478	1,266	74	111	66	2,154	14,464
Rubbish	116	1,755	54	....	54	146	....	1,356	10	298	698	49	43	5	24	164	4,772
Combustibles near heaters	4	....	....	51	....	....	211	....	....	....	....	....	....	....	16	265	547
Open lights, flames, sparks	157	315	203	206	44	122	369	6,456	203	1,134	1,346	151	71	20	21	864	11,682
Hot ashes, coals	20	288	210	41	157	36	57	324	21	332	....	459	5	21	....	206	2,177
Smoking and matches	333	3,184	460	474	241	682	1,703	2,849	254	4,274	325	2,349	102	150	52	4,163	21,595
Children and matches	78	....	....	80	....	....	429	1,140	....	833	174	....	41	....	16	348	3,139
Electrical, fixed service, fires due to misuse, or faulty wiring and equipment	235	3,248	546	465	319	635	723	2,045	270	4,226	307	956	130	75	78	2,080	16,338
Electrical power consuming appliances	116	217	145	238	11	74	379	1,499	5	601	71	335*b*	13	9	18	1,160	4,891
Flammable liquids, misc. including home dry cleaning and starting fires with	26	1,155	145	76	167	323	283	242	91	1,380	117	214	18	137	9	235	4,618
Torches, welding, cutting, plumbers, etc.	27	....	38	48	....	....	105	....	22	252	....	....	12	....	5	97	606
Lamps, lanterns, oil stoves	90	....	156	215	....	....	498	1,146	5	....	118	....	107	....	.....	831	3,166
Gas and explosions	....	106	28	145	59	106	17	....	....	246	89	....	28	1	12	175	1,012
Grease, tar, etc.	20	199	4	36	20	54	133	....	....	302	....	675	9	11	7	578	2,048
Spontaneous ignition	58	391	82	85	33	49	272	411	80	489	140	93	16	13	10	260	2,482
Lightning	26	218	83	71	77	178	125	549	64	379	46	31	34	108	6	5,944	7,939
Thawing pipes	2	....	19	5	....	....	6	122	....	....	....	....	....	....	2	12	168
Sparks from machinery, friction	....	46	11	8	22	91	8	....	....	....	....	138	24	12	1	44	405
Incendiary, suspicious	56	37	22	43	10	12	111	340	58	196	491	34	1	3	16	46	1,476
Miscellaneous	117	849	67	122	91	54	23	11,302	20	1,371	1,377	30	38	36	19	36	15,552
Unknown	259	1,365	1,407	482	756	1,186	181	2,767	205	1,541	....	1,221	74	314	206	852	12,816
Explosions	24	174	212	61	75	38	29	245	98	....	....	187*c*	50	8	21	602	1,824
Exposure	47	506	120	191	141	351	104*a*	....	160	474	36	296	17	152	87	339	2,917
Totals	2,282	17,315	5,368	4,032	2,637	4,951	6,714	40,582	1,977	23,265	5,992	9,673	992	1,307	736	23,336	151,159

[1]Fiscal year ends June 30, 1947.
[2]Does not include Boston.
[3]Fiscal year ends June 30, 1948.
[4]Fiscal year ends May 31, 1947.
[5]Insured claims only.
a. Not included in totals.
b. Includes other hot metals.
c. Includes sparks from combustion.

[3]Fiscal year ends June 30, 1948.

a. Not included in totals.

Table IV. Fire Losses by Causes in Fourteen States — 1947

Causes	Connecticut[2]	Illinois[1,2]	Indiana[3]	Iowa	Kansas	Louisiana	Massachusetts[4]	Nebraska	Ohio	Oregon[3]	South Dakota[5]	Vermont[3]	West Virginia	Wisconsin	Total
Chimneys, flues, defective or overheated	$198,632	$602,091	$448,886	$195,170	$62,113	$86,320	$397,004	$72,650	$650,982	$438,859	$51,117	$56,213	$220,378	$537,796	$4,018,211
Sparks on roof	22,442	334,171	1,654,220	238,550	31,294	72,828	151,517	.....	563,810	193,914	.....	7,709	.....	440,909	3,711,364
Defective or overheated heating equipment	559,488	932,297	2,005,917	612,800	87,526	487,938	825,035	424,705	3,708,887	758,669	111,066	139,659	257,455	1,296,945	12,208,387
Rubbish	195,329	85,552	62,871	.....	63,870	151,008	.....	3,217	213,057	15,558	17,207	1,581	171,474	47,098	1,027,822
Combustibles near heaters	3,745	.....	.....	10,130	.....	.....	183,463	.....	.....	.....	.....	.....	30,780	46,448	274,566
Open lights, flames, sparks	314,092	784,650	106,983	180,250	12,180	630,941	418,177	170,725	423,790	36,593	18,353	8,380	37,839	247,604	3,390,557
Hot ashes, coals	26,647	143,240	1,364,486	80,226	35,388	36,065	117,522	16,895	338,246	75,113	391	29,836	.....	72,242	2,336,297
Smoking and matches	484,560	315,958	440,582	219,847	59,237	524,536	2,722,762	209,546	1,239,419	506,708	29,562	68,850	47,255	1,067,325	7,936,147
Children and matches	51,418	.....	.....	38,245	.....	.....	418,193	.....	415,204	.....	17,317	.....	34,867	166,787	1,142,031
Electrical, fixed service, fires due to misuse or faulty wiring and equipment	538,651	1,816,216	766,070	514,026	315,518	419,636	2,929,068	614,680	2,148,632	1,056,108	192,429	219,518	383,575	2,622,289	14,536,416
Electrical power consuming appliances	224,486	96,683	1,067,552	156,372	2,054	349,309	110,014	9,868	169,783	68,510b	7,197	3,491	66,797	259,943	2,592,059
Flammable liquids, misc. including home dry cleaning and starting fires with	45,125	896,446	877,870	69,983	136,009	299,475	384,290	42,825	1,400,922	255,000	13,928	122,999	22,250	232,903	4,800,025
Torches, welding, cutting, plumbers, etc.	18,988	.....	18,836	110,711	.....	.....	285,355	13,323	161,786	.....	6,858	.....	86,370	73,935	776,162
Lamps, lanterns, oil stoves	116,485	.....	652,143	195,505	.....	.....	603,616	3,275	.....	.....	91,179	.....	.....	780,395	2,442,598
Gas and appliances	.....	112,623	5,242	54,360	71,180	281,176	31,335	.....	453,279	.....	14,427	67	56,150	56,389	1,136,228
Grease, tar, etc.	5,645	243,367	55,200	20,491	5,571	56,768	104,677	.....	234,816	73,528	3,341	4,957	20,490	155,664	984,515
Spontaneous ignition	200,749	417,565	308,819	239,499	33,205	91,149	739,534	136,863	912,875	171,543	25,300	41,324	76,900	799,978	4,195,303
Lightning	78,009	573,476	176,416	416,938	150,496	89,187	182,522	94,341	806,514	30,299	82,400	91,023	110,600	1,302,687	4,184,908
Thawing pipes	45	.....	18,735	2,035	.....	.....	4,350	.....	.....	.....	.....	.....	11,250	1,856	38,271
Sparks from machinery, friction	.....	29,530	12,194	20,932	277,749	91,146	7,542	.....	.....	213,800	37,562	15,585	163,620	10,746	880,406
Incendiary, suspicious	162,569	76,013	19,936	235,912	1,980	21,380	261,104	407,469	498,391	105,132	2,000	6,095	84,420	463,724	2,346,125
Miscellaneous	345,128	108,174	82,866	111,270	85,627	77,972	14,169	15,997	888,136	9,980	13,670	66,159	15,271	32,327	1,866,746
Unknown	1,443,247	9,815,351	6,627,329	3,818,937	2,178,359	3,040,483	1,555,566	1,180,624	6,965,787	3,455,405	377,799	1,620,230	2,354,160	2,474,816	46,908,093
Explosions	90,705	190,884	309,567	141,311	60,188	147,756	85,193	129,511	.....	812,061c	64,861	1,525	157,930	293,114	2,484,606
Exposure	48,707	1,677,343	356,719	613,573	147,312	506,064	149,432a	443,313	412,135	358,143	33,684	249,444	416,422	376,835	5,639,694
Totals	$5,174,892	$19,251,630	$17,439,439	$8,297,073	$3,816,856	$7,461,137	$12,532,008	$3,989,827	$22,606,451	$8,634,923	$1,211,648	$2,754,645	$4,826,253	$13,860,755	$131,857,537

[1]Fiscal year ends June 30, 1947.
[2]Does not include Chicago.
[3]Fiscal year ends May 31, 1947.
[4]Does not include Boston.
[5]Insured losses only.
[6]Fiscal year ends June 30, 1948.

a. Not included in totals.
b. Includes other hot metals.
c. Includes sparks from combustion.

for example, do not report fires with losses of less than $25 to $50. To obtain a more nearly accurate estimate of the number of fires in these sixteen states, therefore, 100 per cent is added. Making use of this figure and the population ratio, the number of building fires for the nation has been calculated.

To obtain the estimated national fire loss the population ratio was applied to the loss of the reporting states. To account for losses not reported through the usual channels, 33⅓ per cent was added as in previous years.

Table V. Fires per 1000 Population and Fire Loss per Person for Sixteen States, 1947, as Reported by Fire Marshals

State	Population 1940 Census	No. of Fires	Fires per 1000 Pop.	Fire Loss	Fire Loss Per Person
Connecticut	1,709,242	2,282	1.34	$5,174,892[1]	$3.03
Illinois	7,897,241	17,315	2.19	19,251,630[1,2]	4.27[2]
Indiana	3,427,796	5,368	1.57	17,439,439[3]	5.08
Iowa	2,538,268	4,032	1.59	8,297,073	3.27
Kansas	1,801,028	2,637	1.46	3,816,856	2.12
Louisiana	2,363,880	4,951	2.09	7,461,137	3.15
Massachusetts	4,316,721	6,714[4]	1.89[4]	12,532,008[4]	3.54[4]
Michigan	5,256,106	40,582	7.72	25,231,853	4.81
Nebraska	1,315,834	1,977	1.50	3,989,827	3.04
Ohio	6,907,612	23,265	3.37	22,606,451	3.28
Oklahoma	2,336,434	5,992	2.56	944,152	.40
Oregon	1,089,684	9,673	8.89	8,634,923[5]	7.86
South Dakota	642,961	992	1.54	1,211,648[6]	1.89
Vermont	359,231	1,703	3.64	2,754,645[5]	7.67
West Virginia	1,901,974	842	.44	4,826,253	2.54
Wisconsin	3,137,587	23,336	7.45	13,860,755	4.42
Total	47,001,599	151,661	3.23	$158,033,542	$3.36

[1]Fiscal year ends June 30, 1947.
[2]Chicago losses and population not included.
[3]Fiscal year ends May 31, 1947.
[4]Boston losses and population not included.
[5]Insured losses only.
[6]Fiscal year ends June 30, 1948.

States Reporting Partial Data (Not Included in Tabulations)

	Population	No. of Fires	Fire Loss	Fire Loss Per Person
Kentucky[1]	2,845,627	4,349	$4,405,658	$1.55
Maine	847,226	.....	13,312,304[2]	16.17
Montana	559,456	664	875,042[2]	1.56
Nevada	110,247	.....	1,577,746[2]	14.29
New Hampshire	491,524	.....	2,045,462	4.16
New Jersey	4,160,165	.....	18,215,563[2]	4.38
New York	13,479,142	.....	49,600,111[2]	3.68
Rhode Island	713,346	1,685	3,035,780	4.26
South Carolina	1,899,804	.....	5,662,168[2]	2.98
Texas	6,414,824	.....	22,239,925[2]	3.47
Utah	550,310	.....	1,159,300[2]	2.10

[1]Fiscal year ends June 30, 1947.
[2]Insured losses only.

Table VI. Estimated Distribution of U. S. Fire Losses by Occupancies, 1947

These estimated figures are intended to show the relative order of magnitude of fire losses by occupancies, and while they are reasonable approximations based on the experience in typical states, they should not be taken as exact records for each class.

	No. of Fires	Loss
I. PUBLIC BUILDINGS		
Government buildings	800	$2,700,000
Hospitals, institutions	1,200	1,500,000
Schools and colleges	2,400	8,100,000
Churches	2,600	9,400,000
Theatres, including motion pictures	1,400	6,400,000
Amusements, halls	3,000	6,700,000
II. DWELLINGS		
Hotels, boarding houses	10,400	7,400,000
Apartments, rooming houses	54,000	13,500,000
Dwellings	250,000	160,000,000
III. MERCANTILE		
Offices and multiple mercantiles	6,800	18,000,000
Restaurants, taverns	12,000	18,800,000
Miscellaneous mercantiles	42,700	91,000,000
Warehouses	9,000	47,200,000
IV. MANUFACTURING		
Metal workers	1,600	9,600,000
Woodworkers	1,400	11,400,000
Flour mills, elevators	2,000	30,500,000
Packing plants	800	4,400,000
Bakeries	1,000	1,000,000
Textile workers	4,200	10,600,000
Printing	600	900,000
Laundries	1,600	4,400,000
Cleaners, tailors	1,800	3,700,000
Miscellaneous manufacturing	16,600	64,000,000
V. MISCELLANEOUS		
Barns	20,800	38,000,000
Outbuildings	28,200	10,900,000
Lumber and coal yards	2,200	17,000,000
Piers, including shipyards	2,200	22,000,000
Railroad property, including rolling stock	5,100	10,300,000
Bulk oil storage, refineries	1,000	15,100,000
Garages, filling stations	27,600	19,000,000
Power plants, pump houses	1,000	4,700,000
Creameries and dairies	800	2,100,000
Miscellaneous structures	21,000	23,000,000
Hangars and contents	200	9,700,000
TOTAL (BUILDING FIRES)	538,000	$703,000,000
VI. OTHER THAN BUILDING FIRES		
Aircraft	50	$3,600,000
Motor vehicles	188,000	8,900,000
Forest fires	200,800	55,200,000
Rubbish, grass, brush	690,000	.....
Miscellaneous	25,000	5,000,000
TOTAL (OTHER THAN BUILDING FIRES)	1,103,850	$72,700,000
GRAND TOTAL	1,641,850	$775,700,000

NOTE: As explained in the text, 100 per cent has been added in estimating the number of fires, and 33⅓ per cent has been added to the losses to cover unreported losses.

Railroad losses have been separated from pier, wharf property fire losses reported by State Fire Marshals. Railroad losses from Association of American Railroads report.

Table VII. Estimated Distribution of U. S. Building Fire Losses by Causes, 1947

These estimated figures are intended to show the relative order of magnitude of fire losses by causes, and while they are reasonable approximations based on the experience in typical states, they should not be taken as exact records for each class.

	No. of Fires	Loss
Chimneys, flues—defective or overheated	30,000	$16,900,000
Sparks on roof	27,000	19,500,000
Defective or overheated heating equipment	44,500	56,000,000
Rubbish	20,000	6,700,000
Combustibles near heaters	6,300	3,900,000
Open lights, flames, sparks	19,200	16,400,000
Hot ashes, coals	6,400	11,400,000
Smoking and matches	87,000	51,500,000
Children and matches	20,800	8,300,000
Electrical, fixed services, fires due to misuse, or faulty wiring and equipment	52,000	56,000,000
Electrical power consuming appliances	15,400	12,300,000
Flammable liquids, misc., including home dry cleaning and starting fires with	20,000	21,800,000
Torches, welding, cutting, plumbers, etc.	4,400	5,300,000
Lamps, lanterns, oil stoves	24,900	26,600,000
Gas and appliances	4,300	5,900,000
Grease, tar, etc.	7,900	4,700,000
Spontaneous ignition	8,100	19,700,000
Lightning	26,600	20,400,000
Thawing pipes	1,100	1,500,000
Sparks from machinery, friction	1,500	5,000,000
Incendiary, suspicious	4,900	10,800,000
Miscellaneous	27,700	11,900,000
Unknown	50,500	208,000,000
Explosions	9,500	77,600,000
Exposure	18,000	24,900,000
TOTAL	538,000	$703,000,000

NOTE: As explained in the text, 100 per cent has been added in estimating the number of fires, and 33⅓ per cent has been added to the losses to cover unreported losses.

Hangar Fires in 1948

The alarming fire record of aircraft hangars continues. In 1946, 21 major fires on NFPA records caused a loss estimated at $6,000,000. In 1947, there were 50 major hangar fires on our records, causing $9,400,000 property damage. So far in 1948 (September), 33 fires in hangars have resulted in losses totaling over $5,000,000. Over 1000 airplanes have been destroyed in these 104 fires. All this while airports, private flying, and commercial aviation are being staggered by the most severe economic crisis in their history.

Ever since 1923, 25 years ago, the average fire loss per hangar has been very high. In 275 hangar fires on NFPA records losses have totaled $70,000,000, producing an average of over $250,000 per fire. This figure has been influenced very materially by a few multi-million dollar fires in large area military and civilian hangars, but even in the average municipal and private hangars the percentage of total losses is so high that unit losses average $70,000 and $30,000 respectively. While hangar structural damages are heavy, they constitute, with only a few exceptions, a minor part of these losses. It is the aircraft destroyed which accounts for the huge losses.

The question poised by these facts and current trends is whether something cannot be done by the industry itself to halt this ruin. The answer is a very definite "Yes." The NFPA Committee on Aviation and Airport Fire Protection has developed "Interim Recommendations for Aircraft Hangar Construction, Utility and Protection" and the information is published in their Bulletin No. 16 (Second Revision) dated February 1948 (available from the NFPA Executive Office at 50 cents per copy).

Some Typical Hangar Fires in 1948

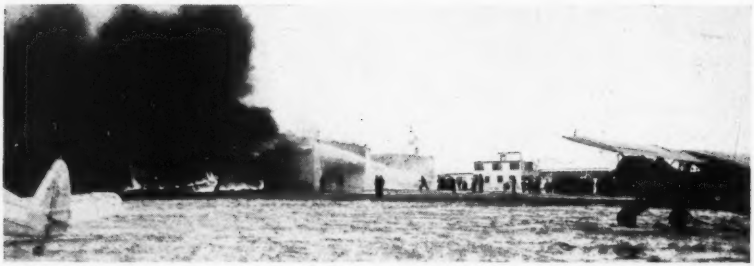
While space does not permit the inclusion of full details on all 33 of the serious fires on NFPA records during the period January-September 1948, the following brief review of some of the significant losses should serve to indicate the seriousness of the current situation at our airports.

January 14, Long Beach, Calif.

Lack of automatic protection or watchman service prevented prompt detection of a fire in the hangar of the Martin Aircraft Service (located outside of Long Beach) on January 14, 1948. These factors, responsible for the delayed discovery, combined with (1) the storage of 23 Piper Cubs in the hangar; (2) large quantities of stored paints and lacquers; (3) combustible hangar construction; (4) lack of fire divisions within the building; and (5) the fact that the airport was located outside city limits and had no fire protection contract with the City of Long Beach or county fire agencies, resulted in a total loss, estimated at between $150,000 and $175,000.

The first alarm was turned in by Chief Frank S. Sandeman of the Long Beach Fire Department, who observed flames when four blocks away from the airport. Long Beach, an Army unit and one engine company from Signal Hill Township responded and fought the fire, despite the absence of a fire protection contract, since flying brands were imperiling the wood shingle roofs of homes in a nearby residential district. The extinguishment efforts were significant only in removing this hazard to exposed properties.

The hangar was a typical wood on unprotected steel structure used for aircraft storage, sales and service. Operations at the airport had ceased for the day and the property left without even watchman service. The fire was discovered by Chief Sandeman at 9:09 P.M., but how long it had been burning prior to this time is not known. This question is an academic one, however, since the contents were extremely vulnerable and, lacking the barest necessities for fire



Nobody called the fire department until an explosion occurred which sent flames throughout the structure. Discovered at 8:49 a.m. by an employee of the Billings Municipal Airport on February 27, the alarm was delayed while employees attempted to use hand extinguishers which were empty.

safety, attempts to control any fire were doomed to failure when it was fueled by 23 aircraft, quantities of flammable paints and lacquers and combustible structural elements.

January 16, Compton, Calif.

A 7500 sq. ft. wood and metal hangar at the Compton Airport was totally destroyed by a fire which was greatly intensified by paints, thinners and lacquers, as well as aircraft, stored in the building. The local authorities clearly indicate that poor housekeeping and failure to cooperate with fire department recommendations were contributing factors and, possibly, the basic cause, although destruction was too extensive for any effective analysis of the fire's origin. Three planes, aircraft parts, spare aircraft engines and some maintenance tools and equipment, as well as important records, were also lost in the fire. The insurance loss paid totaled $42,661 (92% contents), but information is not available as to the actual loss (newspaper estimates run to $175,000).

The alarm was telephoned by one of two employees in the office at 6:50 P.M. The Compton Fire Department responded with two pumpers. The nearest hydrants were 500 ft. and 1000 ft. distant on six-inch water mains, which necessitated placing a pumper at each and stretching 2½-inch lines to the hangar. The two 1½-inch lines on one side were used with water spray (fog) nozzles, which, according to Chief Wetherbee, were very successful in protecting the seriously exposed hangars (only eight-foot clearance on each side) and the fire fighters. All the buildings had metal side walls which allowed tremendous heat radiation, and, with the large amounts of flammable liquids, the heat intensity was terrific. The fog was thus used to protect men and the exposed buildings, while solid streams were used to break up and extinguish the fire within the burning hangar as conditions permitted.

The same airport suffered a loss on July 7, 1947, when a grass fire reached a storage area for junked aircraft, causing a loss estimated from $4000 to $11,000. No insurance protection was carried to cover this loss and a court case is pending.

February 10, Wickenburg, Ariz.

A 155 ft. by 200 ft. wood and stucco hangar (32 ft. high) at the Wickenburg Municipal Airport was totally destroyed by fire during the early morning hours. Two planes and one automobile were also lost in the blaze. Five planes, two gliders and some furniture were removed safely from the building. The hangar cost $68,000 to build in 1942 and the present replacement value is estimated at $95,000.

This airport, located about 20 miles west of Wickenburg, lacked suitable fire protection in the form of adequate water supplies and mobile equipment. The lessee of the field, several flight instructors, student pilots and their families (total 11 persons) lived in a small two-story lean-to attached to the hangar. When the fire was discovered (about 12:45 A.M.), it had progressed beyond the stage where available hand fire extinguishers were useful. Fortunately only one other building (a barracks) threatened to catch fire, but this was prevented by the Wickenburg Fire Department helped by volunteers at the field.

In the situation described above, perhaps it is pertinent to point out that the investment at risk

warranted a degree of fire protection which would have provided those on the scene with the opportunity to exercise control over the fire during its incipient stages. Obviously, this would be possible with fire detection equipment which would have automatically given the alarm to the sleeping occupants before the flames went beyond control. The origin of this fire was presumed to have been from a discarded cigarette or an electrical short circuit in the storeroom containing a large quantity of canvas kits. Permitting a slow-burning fire to go beyond control before discovery, when a hand extinguisher would have saved the day, is penny foolish to the extreme.

Insurance coverage on this hangar is reported at only $15,000, one-sixth of the replacement cost. The airport was occupied by the city under an interim permit granted by the War Assets Administration and was under lease by the city to the Hassayampa Flying Service. The wood hangar was built during the war, when the Claiborne Flight Academy trained pilots at the field, then known as Echeverria Field.

February 18, Fairview, Pa.

A 50 ft. by 80 ft. wood hangar at the Erie County Airport was destroyed by a fire of unknown cause which broke out suddenly at 4:20 P.M. Employees gave the alarm by telephone to the Fairview Volunteer Fire Department, which reached the scene within five minutes with five pumpers and five water tankers. Eight 2½-in., one 1½-in. and seven booster lines were used from the mobile water supplies available to keep the fire from spreading to adjacent buildings located only 10 and 20 feet away from the burning structure. The airport had no hydrants and the sole private source of water was a ½-in. domestic water line.

Seven planes were stored in the building, five with batteries installed and connected. The apparent center of the fire was in the shop area (wood floored), which contained supplies of engine oil, lacquer dope, lacquer thinner, aircraft hardware, tools and aircraft parts, as well as two of the seven planes. While this shop area was subdivided from the balance of the hangar, the cut-off was not sufficient to permit saving any of the building or its contents.

The loss is divided: $8000 on building ($4500 insurance), $23,400 on contents (insurance $6170). The loss was thus almost three times the insurance coverage.

February 20, Deming, N. M.

A mechanic washing coveralls in a can of gasoline eight feet from an open flame heater was responsible for this fire, which destroyed a 28,500 sq. ft. unsprinklered wood hangar and 12 personal aircraft. The ignition of gasoline vapors quickly spread flames throughout a small shop area (about 60 ft. by 27 ft.) which contained a propeller pit and approximately 25 gals. of paints and thinners. It appears likely that the vapors collected in the pit and, when ignited, caused an explosion which shot flames out through a 14 ft. opening into the main hangar area. The opening was equipped with a sliding door, but available evidence indicates that this must have been open at the time of the fire.

The main hangar area was 190 ft. by 96 ft. and 65 ft. high. The lean-to's on each side were two-story structures which ran almost the full length of the hangar, each being 27 ft. wide. The latter were subdivided (on the ground floor) into repair shops, storage areas, boiler rooms, and living quarters. Both of these sections, except the boiler rooms, had protected openings into the 65 ft. high center section (boiler rooms had exits only in exterior walls). The roof was wood plank with tar paper over the sheathing.

Employees gave the alarm of fire by telephone at 4:15 P.M. Firemen from the village of Deming department responded, but, in the words of Chief Simonds, all they could do was to "surround the fire" to prevent it from spreading. Even in doing this they were handicapped. Four hydrants were so close (50 ft.) to the burning hangar that none of them could be used and 300 yards of hose had to be laid from a hydrant in the next block. The twelve aircraft destroyed included Stearmans, Cessnas, Piper Cubs, Ercoupes, a Bellanca and some army surplus trainers. In addition, four private automobiles and, ironically, one class 110 crash truck were destroyed.

The fire was the second reported in 1948 to level a war surplus hangar which had been converted to civilian use. The dollar loss is estimated by Chief Simonds at $700,000. In 1947 there were three major former Army or Navy hangars which suffered similar fates—at Honolulu, at Miami, and at St. Joseph, Missouri. The aggregate dollar loss from these four fires can be estimated conservatively at $4,500,000, with a

Glasgow Courier.

This war surplus hangar, 120 ft. by 160 ft., was totally destroyed by fire at Glasgow, Montana, on March 8. The Control Tower shown in the foreground collapsed after heat weakened the exposed steel framework. Seventeen planes were destroyed, since the storage area was not segregated properly from the maintenance shop where the fire originated. The hangar was uninsured because of high rates.

total of 27 aircraft destroyed. The reasons for such large losses, apart from the particular causes of ignition, are identical: (a) Combustible construction; (b) Lack of automatic protection; (c) Insufficient subdivision of large areas; (d) Large quantities of flammable liquids involved.

February 27, Billings, Mont.

It was 8:49 A.M. when an airport employee arrived at the Billings Municipal Airport and discovered a fire in the repair shop section of Hangar No. 1. He and other employees attempted to control the fire with those carbon dioxide, soda-acid and vaporizing liquid extinguishers available. They were empty.

The volunteers next proceeded to remove eight planes from the threatened structure by opening the overhead doors and rolling the aircraft out by hand. Two other "knocked-down" planes in the repair shop were not mobile and could not be saved.

While the above activity in the interest of reducing the amount of fire loss was pathetically commendable, the first cardinal rule had been ignored—*nobody called the fire department*—until an explosion occurred which sent flames throughout the structure and made impossible any hope of achieving real fire control.

Sacrificed at the feet of the biggest bugaboo of fire waste—delayed alarm—was the 80 ft. by 160 ft. main hangar, an adjoining small private hangar, and three communicating garages (used as storage facilities and an office). The dollar loss is conservatively estimated at $40,000 (newspaper estimate, $100,000).

The hangar was a wood and stucco building containing repair and paint shop facilities, spare parts storage, idle aircraft stowage, an office and a heating plant. Fuel oil, paint thinner, anti-icing fluid, and other flammable liquids were stored throughout the building. No watchman service was provided. Housekeeping was reported as poor. First aid fire fighting equipment was not adequate and, as reported above, those available on the day of the fire were empty.

The Billings Fire Department answered the alarm with two pumpers. Since the airport was outside city limits, they had a 2½-mile run, uphill, to the scene. Their response was clocked at four minutes from the time of the alarm. Three 2½-in. and six 1½-in. hose lines were laid to protect nearby exposures, the hangar itself being so totally involved that nothing could be done at this late hour to save any of the structure or its contents.

March 8, Glasgow, Mont.

Seventeen personal aircraft were destroyed when fire swept through the main hangar at Glasgow Airport during the late afternoon of March 8, 1948. The fire originated in the shop section of the 120 ft. by 160 ft. structure, which was built in 1942 at a cost of $220,000. The control tower also collapsed after the heat weakened the exposed steel framework.

This field, like that at Wickenburg, Arizona, and Deming, was under the control of a city-county airport commission with an interim permit from the War Assets Administration. According to local advices, the hangar was uninsured because "the rate for the airport was at a figure which would have been impossible to pay from the amount raised by airport levies." The total direct property loss is estimated at $300,000, but information on the effect on local air operations is not available to the NFPA.

The fire originated while mechanics were doping the wing of one of the planes in the shop. The exact cause of ignition was not precisely reported but, apparently, a careless act of some kind was responsible for a flash fire which spread with such violence that it was fortunate that the occupants escaped with their lives. The alarm was telephoned to the Glasgow Fire Department, but, by the time their equipment could reach the scene (two miles beyond city limits), the building was "a blazing inferno." Chief M. M. Roach stated that: "There was no chance of saving it, or even controlling the flames . . . we did not even hook up our hose lines." One government owned pumper was stationed at the field with one paid operator, but the operator was not at the airport at the time of the fire.

March 11, Bethany, Okla.

A long undetected early morning fire (estimated at 45 minutes) was responsible for the total loss of a hangar and 31 aircraft at the Tulakes Airport (Southwestern Airways) near Bethany, Oklahoma, nine miles outside Oklahoma City. The detection was delayed until the fire was beyond control because of the lack of automatic detection equipment, the absence (with owner permission) of the watchman on this particular night, and the fact that a blinding snow storm concealed the fire in its incipient stages from any chance passers-by.

The foreground collapsed after heat weakened the exposed steel framework. Seventeen planes were destroyed; three were damaged. Note the sloping roof of the maintenance shop where the fire originated. The hangar was uninsured because of high rates.

The hangar was a conventional, unprotected, all-metal structure 200 ft. by 200 ft. On two sides of the hangar 25 ft. wide lean-to's cut the actual aircraft storage area to 150 ft. by 200 ft. One lean-to was subdivided into shops, while the other was partitioned into office, lounge, and parts storage areas. The main hangar and shops were heated by eight overhead vertical gas heaters (20 ft. from the floor, 8 to 10 ft. from the roof, and 20 to 30 ft. from side walls). The heaters in the office side lean-to were cabinet type, gas, convection and radiature heaters, four in number. It has been established that while the heaters in the main hangar and shops were "off" when the fire took place, the cabinet heaters had been left on (outside temperature –4°F) at the direction of the owner when he and five employees left the airport during late afternoon.

The alarm of fire was received by the Oklahoma City Fire Department via Highway Patrol radio and telephone at 4:10 A.M. They responded with two pumpers, a hose wagon, and a ladder truck, but were delayed by snow drifts and the storm conditions. The sole hydrant available was on a two-inch main and was frozen. By the time water could be secured, the limited supply was practically useless. Remarkably, the unprotected metal hangar did not collapse, although the heat was sufficient to melt the glass window panes, to reduce the metal structural members of the aircraft in storage to a mass of twisted rubble, and to cause such severe warping of the unprotected hangar structural members to render the building useless.

Evidence indicates that eight gasoline tanks in the stored aircraft (at different locations in the hangar) exploded. The effect of these explosions, however, was not severe enough to cause major structural damage.

The cause of the fire has not been determined with accuracy, but the most plausible explanation is that the unit heaters in the office side lean-to (left on overnight and unattended) were responsible.

Of the thirty-one aircraft destroyed, 12 belonged to Southwestern Airways (operators of the field). Ten others were insured and nine were not insured. The dollar loss is estimated at $130,000, $60,000 on the hangar, $25,000 on contents other than aircraft, and $45,000 on aircraft, but the aircraft loss estimate appears low. Chief McAlpine of the Oklahoma City Fire Department, reporting the loss to the NFPA, stated that "if this fire could have been reported im-

James N. Spence, Niles Daily Star.

Nineteen aircraft skeletons are all that remained after fire destroyed the hangar at Niles Municipal Airport, near Niles, Mich., on March 14.

mediately . . . we could have reduced this loss to no more than 50% of what it was and maybe less."

March 14, Niles, Mich.

Nineteen private planes and a hangar were destroyed by a fire at the City of Niles Airport, which was first discovered by a passing motorist at 8:10 P.M. The airport was closed at 6:00 P.M. and no watchman or caretaker was employed. When the alarm was given and city fire equipment reached the scene, the fire was so far beyond control that nothing could be done to save any part of the 80 ft. by 100 ft. hangar or the 10 ft. by 40 ft. office addition. The nearest hydrant was 3200 ft. distant, and one line was laid in the hope of saving some part of the concrete block and wood roof structure or of the contents, but the effort proved fruitless. The airport was ½ mile outside city limits and the hydrant used was the nearest one on city mains.

March 16, Oklahoma City, Okla.

"Fast work and plenty of extinguishers saved a lot of airplanes." This statement by Don Magee, Aero Insurance Underwriters' engineer, sums up what happened at the Downtown Airport in Oklahoma City on March 16th.

The fire was discovered at 11:00 A.M. by a mechanic cleaning a motor on one of the planes and by a passenger in a landing aircraft who reported his observation as soon as they reached the line. Twenty-eight planes were stored in the building at the time, and as airport personnel and visitors arrived at the scene, the rear fuselage section of a Piper Cruiser was observed burning and flames spreading quickly to other planes stored nearby. Despite the obvious danger, some of the volunteers used carbon dioxide hand extinguishers to hold the flames in check while others removed twenty-one of the twenty-eight threatened aircraft from the hangar to safety, all within seven minutes elapsed time. Only four planes were totally destroyed, three others being partially damaged (fabric surfaces burned off wing surfaces).

The hangar was 150 ft. by 300 ft. and was of typical all-metal construction (metal on unprotected steel trusses). It had doors on three sides, which made every area accessible. The doors downwind were first opened and aircraft near by pulled outside. These doors were then closed and the next side doors opened, with more accessible aircraft removed. After closure, the last side was opened to complete the task except for those planes already heavily involved in the fire.

This fire at the Downtown Airport in Oklahoma City on March 16 started from a short circuit at the battery box (foreground) caused by lack of insulation between the metal lid and lead wires.

While this was going on, other volunteers were successful in checking the progress of the fire with the hand carbon dioxide extinguishers. They attacked the fabric wing surfaces in relays, and while they could not prevent reignition, they did slow the fire down enough so that when the fire department arrived they were able to finally extinguish the flames with booster tank hose lines supplemented by water supplied from a 500-gallon tank truck. (The closest hydrant was three blocks away and was not used.)

The evidence on the cause clearly points to an electrical short circuit at the battery box on the Piper Cruiser, believed caused by the lack of insulation between the metal box and the lead wires. The loss to aircraft is estimated at approximately $13,000. The hangar was not damaged beyond soot on the roof stringers.

March 18, Daytona Beach, Fla.

Two twin engine Cessnas were destroyed and one PT-26 was damaged by a fire that originated when a spark from the battery of one of the Cessnas ignited gasoline vapors released from a fuel spill on the hangar floor. The aircraft involved were undergoing maintenance in a small (40 ft. by 50 ft.) leased steel and corrugated

iron hangar. The building was located across the flying field from the main airport facilities.

The fire alarm was given at 11:05 P.M. by the CAA Control Tower operator, who observed the flames before a mechanic (working on the Cessna originally involved) was able to radio the alarm to the tower from a plane standing on the apron in front of the hangar. A crash truck located at the airport (¼ mile from the hangar) and operated by the Daytona Beach Fire Department, answered the alarm, reaching the scene by driving across the runways. In addition, a 750 gpm pumper responded from the city but had to make a run of about three miles.

Control over the fire was secured by the use of high pressure water spray (fog) from the crash truck plus booster lines from the pumper's water tank. Damage to the three planes is estimated at $40,000, indicating that despite the efforts towards extinguishment they were too late for the type of fire on hand.

April 3, Laredo, Texas

Fourteen aircraft and an 80 ft. by 120 ft. hangar (30 ft. to highest roof point) were destroyed by a fire first discovered by neighbors at 11:30 P.M. when the airport was not in operation. Watchmen on duty did not have compulsory hourly rounds or clock stations and were not aware of the fire prior to its being noticed by persons in a government housing project seven blocks from the airport.

The property was located just outside the city limits of Laredo. A twelve-inch water main was connected to the city supply and hydrants were spaced near the hangar, the closest being 30 ft. distant. The airport maintained a booster station and the pressure available at the hydrants averages 55 to 60 lbs. under standard fire flow conditions.

The alarm of fire was telephoned to fire headquarters and relayed to the airport fire station, located five blocks from the hangar. Response included four pumpers from the city and airport stations, but by the time this equipment reached the scene a succession of minor explosions or flash fires, originating in the fuel tanks of the aircraft stored in the building, made control impossible. Four 2½-in. hose lines were used to cool the area affected, but all aircraft and three-quarters of the hangar were lost.

The hangar was the conventional brick and hollow tile type with a steel truss roof of the arch type (composition covering). Reinforced concrete was used to provide roof supports. Large folding doors provided the normal openings at each end of the hangar. Fortunately, the hangar was well separated from other airport buildings.

Aircraft involved included seven Cessnas, a Beechcraft, a Taylorcraft, an Aeronca, an Aircoupe, a Luscombe, one BT-13 and a PT-22. Most of the planes are owned by the Edgerton Flying School, tenants in this building.

The cause of the fire could not be determined with accuracy because of the extensive damage, but careless smoking in and near the hangars had been noted repeatedly and the supposition advanced locally is that the fire may have originated from a carelessly discarded cigarette. The fire loss figures submitted show the total estimated at $34,000, $20,000 of which was on contents (including aircraft).

June 1, Des Plaines, Ill.

Sparks from a welding torch which ignited the wing fabric on an aircraft undergoing repair in a 40 ft. by 75 ft. hangar (16 ft. high) were responsible for this fire, which destroyed the building, four aircraft in the hangar and others parked near by.

The alarm of fire was given to the Des Plaines Fire Department by telephone, some delay being experienced in contacting the operator. By the time firemen could reach the airport, located three miles outside city limits, the entire structure was involved. Three engine companies were employed and one 2½-in. hose line and two 1½-in. lines were used for drafting water from a creek 1150 ft. from the hangar. This creek was the sole source of water available, except for booster tank supplies on the fire equipment.

The hangar was constructed of concrete block with wood trusses and wood roof covering. One side of the hangar, exposing by six-foot separation an all-wood hangar, was fortunately without window or door openings, allowing firemen to prevent spread to this very vulnerable building. In the front, however, hangar doors were open and heat radiation caused a Stinson aircraft stored within twenty feet of the hangar to burst into flames before it could be moved (see photograph). One other Stinson, stored on the line 400 to 500 ft. from the first, and a Stearman, 25 ft. from the second plane, were also

International News Service.

Heat radiation from a burning hangar at Ravenswood Airport, near Des Plaines, Ill., caused ignition of these aircraft stored on the field on June 1.

ignited and destroyed; eight other aircraft on the line were towed to safety.

June 10, St. Joseph, Mo.

The speed of fire spread in a combustible hangar filled with fueled aircraft is tragically illustrated by this fire at the Municipal Hangar, Rosecrans Field, St. Joseph, Missouri, June 10, 1948. The loss provides convincing evidence of the need for automatic protection. It proves that reliance on irregular watch service is false security. It shows the limitations of manual fire extinguishment in a large area combustible structure following even a slightly delayed alarm.

These lessons should have been learned earlier, for, a year previous (July 23, 1947), another combustible hangar burned to the ground at this airport, causing a loss estimated at $820,000 under markedly similar conditions.

Discovery and Alarm

At about 4:25 A.M. a watchman, while on the east side of the hangar, smelled smoke, and, upon investigation, discovered smoke and a small blaze in an office located in the northwest corner of the 160 ft. by 170 ft. wood hangar. He immediately called the control tower and reported the fire, asking them to call the fire department. He attempted to extinguish the flames with a hand chemical extinguisher but was not successful. The tower operator transmitted the alarm, in turn, to the airport fire station (operated by the St. Joseph Fire Department), who relayed the call to downtown fire headquarters. The one fire company at the airport responded to the hangar and it is estimated that they reached the scene within five minutes of discovery.

Fire Fighting

While the first hose line was being laid, the fire was still confined to the office section but was eating through lightly constructed partitions into the hangar proper. The main hangar door was open and about the time water was initially directed on the flames an explosion occurred which spread fire throughout the entire interior of the structure. City based fire equipment was arriving by this time (three pumpers) and additional hose lines were laid (total: 5 lines) to protect a group of frame buildings seriously exposed. This could not be accomplished, however, before the closest (only 50 ft. separation) was ignited. The heat became so intense that fire fighters were forced to retreat so far that water from their hose streams (ample supplies) fell on the concrete aprons around the hangar instead of on the burning embers. Efforts were then concentrated on protecting the other exposed buildings. The magnitude of this task might be realized when it is reported that glass windows in the control tower, located 350 ft. from the burning hangar, were cracked.

The Damage

Seventeen airplanes were totally destroyed, as well as the 27,200 sq. ft. hangar (40 ft. high)

Wide World Photo.

The destruction caused by this fire is estimated at from $300,000 insured loss to $1,000,000 actual loss. It was the second major fire at Rosecrans Field, St. Joseph, Mo., in one year.

and the 12,700 sq. ft. exposed building (National Guard Officers' Club). Aircraft involved included one converted B-25, five Cessna 120's, three Taylorcrafts, two Navions, one twin engine Cessna, one BT-13, one Piper Cub, one Cub Cruiser, one Funk, and one Beech Bonanza. The dollar loss is estimated at $300,000 by insurance authorities (not adjusted), although the airport manager is quoted in the press as estimating that the actual loss "would be closer to $1,000,000" than his original tentative estimate of $875,000.

July 10, Teterboro, N. J.

This fire may be attributed to the angle storage in a hangar of a fueled Taylorcraft and to subsequent gasoline leakage. While the exact cause of ignition cannot be definitely stated because of the extent of the damages, a logical explanation is that a static spark ignited the flammable vapors released by the gasoline spillage.

Despite prompt fire alarm transmission, the hangar and 56 aircraft were destroyed as manual fire fighting efforts were shown to be hopelessly outclassed by the hazards of this type occupancy. The hangar was owned by Bendix Airport, Inc., and occupied by the Rausch Flying Service and the Safair Flying Service.

Origin of the Fire

During the early evening of July 10 the affected hangar was filled with aircraft, some being upended to secure maximum utility of space limitations. Overflow aircraft were tied down on the ramp. All on-duty mechanics departed from the field about 10:00 P.M. A combination watchman-janitor-night superintendent was left in charge of the property.

Between 10:15 and 10:30 P.M. the watchman was on his way across the hangar to extinguish lights when he observed a drop of gasoline coming from the engine of a Taylorcraft (1946 model) in angle storage. As previously instructed, he proceeded to open the cockpit door to shut off the gas cock. A "blinding flash of flame" occurred simultaneously with the opening of the cabin door which, momentarily, felled the victim. The watchman quickly regained his feet and rushed to secure a fire extinguisher, when an explosion occurred which forced him out of the hangar. Breaking into the office, he called the fire department as other airport personnel assembled to fight the fire with hand extinguishers and to move automobiles and aircraft surrounding the hangar to a safe distance.

Obviously the gasoline vapor-air mixture in the atmosphere near the cabin door was within its explosive range when the leakage was investigated. Whether this flammable vapor-air mixture was within the aircraft cabin or lurking around the exterior of the upended aircraft is not known. Under either condition, a low-intensity static spark (either from an electrostatic charge on the person of the watchman, or, more likely, on the ungrounded aircraft) would be capable of causing ignition of the vapors.

Subsequent to this initial outbreak, the explosion which occurred can be attributed to the development of heat which was sufficient to bring the gasoline in the aircraft to its ignition temperature and, being confined, to explode this fuel. The aircraft had been filled with gasoline (18 gallons) earlier in the day and a local flight had consumed about three gallons.

Fire Spread

Spread to the adjacent stored aircraft in the crowded hangar was so fast that any attempts to halt the blaze with first aid fire exinguishers did not have the remotest chance of success. Once beyond this range, the fire quickly engulfed one entire half of the 245 ft. by 90 ft. hangar (14 ft. high to eaves, 28 ft. high to ridge), and efforts of field crash truck personnel, volunteers, and firemen from the adjacent town volunteer fire department were doomed to failure. An 8-in. cinder block fire wall which extended to the underside of the roof truss and divided the 26,500 sq. ft. hangar into two sections was the only possible fire stop in the structure. Unfortunately, since this division wall did not go through the roof, was not parapeted and had one unprotected opening, the fire also spread quickly to the other half of the building via the wood roof, the plaster board on wood stud section of the division wall which blanked-off the opening between the trusses and the roof, and the unguarded opening. The unprotected steel roof trusses themselves were warped into grotesque shapes. The concrete block walls were severely damaged.

Fire Fighting

The fire fighting facilities at the airport included twelve-inch water mains with sufficient hydrants located near the principal buildings. The airport also had a crash truck with two men on duty. There were no automatic sprinklers in the hangar involved. The Hasbrouck Heights Fire Department responded with a pumper, a hose wagon and ladder truck. Two 2½-in. hose lines were employed in the losing battle, with both solid streams and water spray used. The nearest hydrant was 90 ft. from the building. A five-mile an hour wind did not have an appreciable effect on the fire. Many aircraft seriously exposed on adjacent ramps were saved by firemen and volunteers.

Losses

The only loss figures available are estimates, but they are believed fairly accurate by the airport management. Loss of records and inventories by the fire contribute to the difficulty of establishing definite dollar figures. The hangar loss is set at $150,000; contents, estimated at $350,000; total, approximately $500,000.

July 12, Moberly, Mo.

A 100 ft. by 100 ft. all-metal hangar (22 ft. high) at the Omar M. Bradley Airport was only slightly damaged despite a fire which destroyed eight aircraft in the structure. The unusual "save" can only be attributed to effective use of foam by the Moberly Fire Department and to favorable weather conditions (raining).

The fire started while a mechanic was working on a fabric covered Taylorcraft in one corner of the hangar. While the exact cause of ignition has not been determined, it is presumed that heat from an electric light bulb or an extension cord ignited the cellulose nitrate doped fabric. Fire was propagated to other stored aircraft within the hangar by ignition of fabrics and explosions of gasoline tanks. A fire door, segregating a lean-to (housing an office, shop and classrooms), prevented damage to this area.

Fire department running time to the out-of-town location was somewhat lengthened by a train blocking the shortest route but, even with this delay, fire fighters accomplished a genuine "stop" by the use of mechanical foam. The responding pumper had a 250-gal. booster tank and, by utilizing this limited water supply for foam, the maximum extinguishing effect was produced. There was no additional water available at the airport.

Aircraft destroyed included two Taylorcrafts, two Piper Cubs, one Aeronca, one Stinson, one Ercoupe and one Cessna. The loss to aircraft is estimated at $8000, and the building loss is approximately $860.

July 27, Norton Township, Ohio

Lightning struck the wood gables on a 22 ft. high hangar and fire broke out immediately. Flames traveled along the wood roof trusses and extended to an adjoining repair shop and, thence, to a two-story office section, resulting in a total loss to all three adjoining structures. Seven planes (four Aeronca 7 AC's, a Stinson 150, a Stinson 80, and a Luscombe) were destroyed plus one dismantled Fairchild, repair and shop supplies, and some records. The loss is estimated at $65,000.

The alarm of fire was given at 8:20 P.M. by

an employee who saw the lightning strike. A meeting in progress in the office section provided immediate manpower (15-20 men) for such salvage work as was possible and considerable furniture, current files and records were thus saved. Flame-spread barred effective use of hand extinguishers or attempts to save any aircraft.

The Norton Township Volunteer Fire Department, plus Barberton, Doylestown and Clinton departments, responded to calls for help, but travel distances delayed their arrival and absence of any water at the airport rendered their fire fighting efforts impotent. Booster tank water supplies were utilized but such quantities were no match to the flame-spread. Fueled aircraft, paints and oils in storage, plus winds of 25 mph (with gusts recorded up to 40 mph) were overwhelming odds.

Fire spread from the hangar proper (hollow concrete block walls, wood roof trusses and gables, sheet metal roof covering) to the repair shop section (similar to hangar except asphalt shingle roof covering), followed along the common roof trusses and then went through the roof of the repair shop to ignite the all-wood, two-story office building. The entire area (all three sections) was actually one fire area because of openings in both hollow block walls separating the units. One non-standard fire door (tin-clad) in the hangar effectively prevented fire passage until the wall collapsed.

It is reported by local authorities that the airport management was fire conscious and provided ample extinguishers, posted "No Smoking" signs and maintained good housekeeping conditions. They did not, however, provide lightning protection and advice given by the local fire department recommending ground cisterns for emergency water supplies was not heeded.

August 18, Readington Township, N. J.

A fire which originated in an automobile caused tremendous damage when it spread from a two-car garage building to destroy a near-by 120 ft. by 80 ft. hangar largely filled with stored War Assets Administration war-surplus aircraft parts. The essential reasons for the large loss and rapid spread were:

1. Close grouping of combustible buildings.
2. Lack of installed automatic fire protection equipment.
3. Insufficient water supplies for fire fighting.
4. Remote location of airport from established fire protection.

The building loss is estimated at $40,000, owner contents at $20,000, and government property between $2,000,000 and $3,500,000.

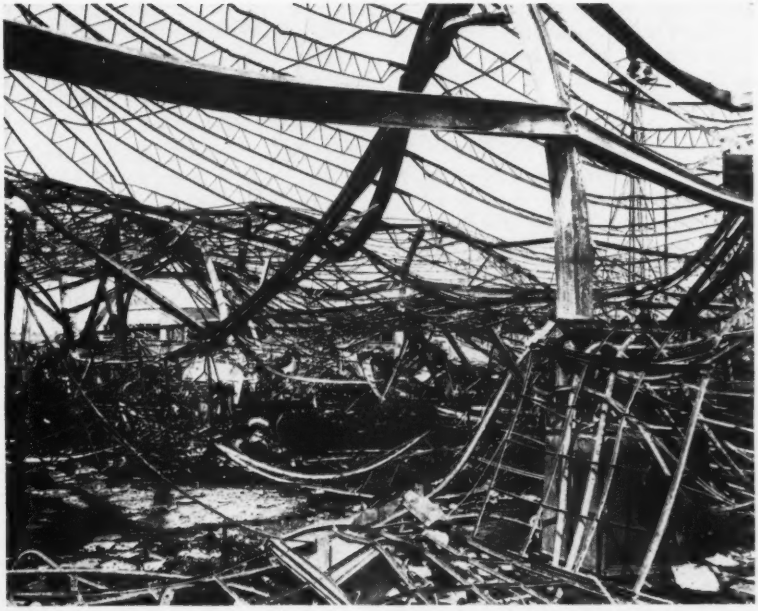
The Fire Story

The fire in the automobile (caused by an electrical short circuit) was discovered by an airport mechanic about 1:00 P.M. The alarm was telephoned to the nearest fire departments, three and eight miles distant, at Whitehouse and Flemington, N. J. In all, eight fire companies from surrounding communities eventually responded to the alarm. When the East Whitehouse Fire Department arrived, the first to reach the scene, the garage was fully involved despite interim efforts of employees to stem the spread with hand extinguishers. Winds of from 12 to 20 mph and the close grouping of buildings required that full attention be given to the exposed structures.

Booster tank water supplies on the first pumper were utilized to protect the seriously threatened restaurant building until additional fire equipment could arrive. The only source of water at the airport proper was rain water which had fortunately collected in an old cellar foundation (30 ft. by 40 ft. by 8 ft.) about 1400 ft. from the fire scene. Hose lines were laid to this source after more equipment arrived but, by this time the main hangar was heavily involved and fire fighters could only hope to save three "T" hangars and the restaurant. About 30 aircraft around the hangar and seven inside the building were saved except for one Interstate Cadet trainer which was ignited by sparks while on the field.

Construction Details

The garage where the fire originated was an ordinary wood building capable of housing two or three cars. A 25 ft. square wood frame building (used for lumber storage) was separated by a clear space of about only six feet and acted as a flame carrier (as it became involved) to the larger hangar, which was also just 6 ft. distant. This latter structure was a metal-clad frame building 40 ft. high. A cinder block division wall which did not extend the full height of the hangar divided the WAA parts storage section from the aircraft storage, but was not effective in stopping the flames because of its structural



Dante O. Tranquille.

This tangled mass of steel once supported the wood roof of the 100 ft. by 120 ft. main hangar (40 ft. high) at the Utica Municipal Airport. On August 19 fire, fed by eight fueled planes, consumed the structure with the results indicated.

shortcoming (not parapeted). Thus all three buildings were lost and other near-by buildings would most surely have been destroyed were it not for the persistent efforts of the volunteer fire departments who had so little to do so much.

August 19, Utica, N. Y.

Fire totally destroyed the main hangar at the Utica Airport as the lack of installed automatic protection was illustrated to be a tragic omission. Located five miles outside city limits, fire equipment response was naturally "too little, too late" for flames which were fed by eight fueled aircraft.

The hangar was a substantial brick structure with a wood plank roof on unprotected steel roof supports. The building measured 100 ft. by 120 ft., approximately 40 ft. high. Built in 1929 at a cost of $45,345, the sound value of the hangar, under current conditions, is estimated at $125,000. Naturally the wood roof was highly vulnerable to fire attack, and early photographs show how quickly it was penetrated. The unprotected steel roof supports, under the terrific heat barrage, warped and eventually collapsed.

Witnesses indicate that the fire originated in one of the stored aircraft, and one observer stated: "There was one woosh of flame from one of the ships and the whole corner of the hangar was a sheet of fire in a matter of seconds."

Volunteers opened hangar doors and managed to roll about 10 aircraft on to the field before they became involved. Those planes lost included four Piper Cubs, two Taylorcrafts, and two Aeroncas.

The Utica Fire Department sent one pumper to the scene which was a supplement to a volunteer company from near-by Stittville. This assignment was prearranged according to a mutual aid agreement in effect in Oneida County. Such limited equipment in the face of a fire of this magnitude was obviously "too little," but even if stronger assignments had been dispatched the time delay involved due to distance factors would have been "too late." Only proper

automatic protection, *specifically designed for the occupancy hazards involved,* would have been capable of holding this fire in check.

Loss estimates range from $150,000 to $250,000.

September 20, Boston, Mass.

Strangely enough, the only fire reported to the NFPA so far in 1948 that occurred in a sprinklered hangar was not affected by their operation. The sprinklers installed were on a deluge-designed system but with sealed heads, this arrangement being necessitated by inadequate water supplies from public mains in the area. Despite the fact that two systems were tripped manually within a few seconds of initial outbreak, only five heads operated and these were in the last bay in the hangar where their discharge could not be effective.

This fire occurred at the Eastern Air Lines hangar at Logan Airport in Boston at 1:41 P.M. Caused by the release of four magnesium flares from a twin engine Cessna, fire immediately involved this plane, spread to a second Cessna and involved the fabric aileron of a DC-4 stored in the hangar before fire equipment could reach the scene. Quick action by the crew of a Class 155 (Army surplus) crash truck with water fog permitted extinguishment of the fire on the DC-4 before it developed to sufficient intensity to involve 600 gallons of gasoline in the immediately adjacent integral fuel tanks. Fortunately, neither of the two Cessnas was fueled and the doped fabric burned itself out rather quickly as firemen applied water fog to cool down the area. The magnesium flares burned viciously for their duration and left marks on the concrete floor to attest their heat intensity. Outside of this negligible damage, the all-steel, 200 ft. by 200 ft. hangar (50 ft. high at peak) was not damaged.

Obviously, if open heads had been installed in the deluge designed system, water would have been discharged directly on the fire area when the systems were manually tripped. Heat built up rapidly in the hangar and the heat actuating devices automatically tripped all the releases of the three systems very shortly after the two had been activated by the alert hangar supervisor. Whether this water curtain would have saved the second Cessna and prevented damage to the DC-4 is pure conjecture, but based on previous hangar fires where standard deluge sprinkler protection was afforded, the chances of success were excellent. Only the very fortunate fact that the crash crew were on a chance run in the vicinity and were thus able to respond instantly to the alarm saved the day in this case.

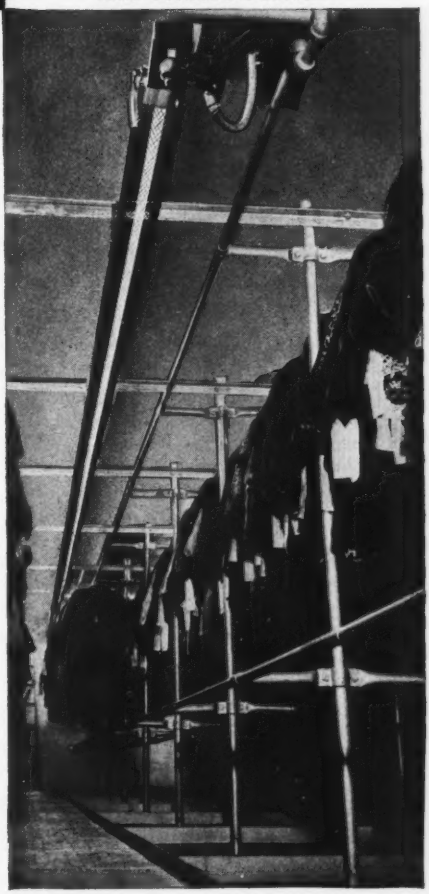
Lack of water in the public mains has been a static condition since the sprinkler protection was installed in early 1946. This is somewhat ironic since the airport is surrounded on three sides by water.

Other Fires at Airports

Besides these hangar fires, losses have occurred at the Gillis Flying Service, Northampton, Mass., two at Shannon Airport in Ireland, the facilities of the Holston Flying Service in Chilhowie, Virginia, at the Appleton Municipal Airport, Appleton, Minn., at the Amanda (Ohio) Airport, at Patricia Bay, British Columbia, at Kennewick, Washington, Porterville, Calif., Rolla, N. D., and a large loss fire at Amarillo, Texas. In addition to these hangar fires, there have been three reported fuel servicing truck fires at airports, one fatal oxygen explosion (2 deaths), and one flight line fire involving a DC-4 at La Guardia Field, N. Y., also attributed to oxygen. Not included in this article are an estimated 200 aircraft crash fires that have occurred on or in the immediate vicinity of airports during the current year.

SOLVES THE PROBLEM OF FIRE SAFETY IN FUR STORAGE VAULTS...

ADT *Automatic Smoke Detection and Alarm Service*



No longer need there be danger of heavy damage from smoke or fire in fur storage vaults and similar high value enclosures.

ADT Automatic Smoke Detection and Alarm Service now provides a high degree of fire safety for such establishments by means of devices which detect the presence of smoke, automatically give an alarm and automatically close dampers and shut down fans.

Especially engineered and designed for protective purposes, these devices operate instantly whenever smoke intercepts a beam of light. Incipient fires are thus detected and reported, *often before there is any sign of heat or fire.*

Air ducts of air conditioning or other air circulating systems may be similarly protected by means of the same type of devices.

Continually dependable operation is assured by constant supervision, regular inspections and complete maintenance, provided through ADT Central Stations.

Write for further information.

ADT

Controlled Companies of

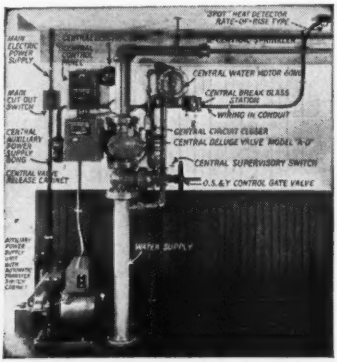
AMERICAN DISTRICT TELEGRAPH CO.

155 SIXTH AVENUE NEW YORK 13, N. Y.

Central Station Offices in all Principal Cities of the United States

There is always the One Best

Central "Electro-Speed" Deluge Sprinkler System Model "AD"



Completely Electrically Operated

• • •

Rate of Rise and Fixed Temperature Controlled

• • •

Fully Supervised

"A PRODUCT OF THE ELECTRONIC AGE"

Over six years ago we pioneered the first Underwriters approved electrically operated deluge type automatic sprinkler system. We now present, in the CENTRAL Model "AD" Electro-Speed Sprinkler System, a completely new and all electrically operated system, amazing in its simplicity of design and in its instantaneous super-speed electric operation.

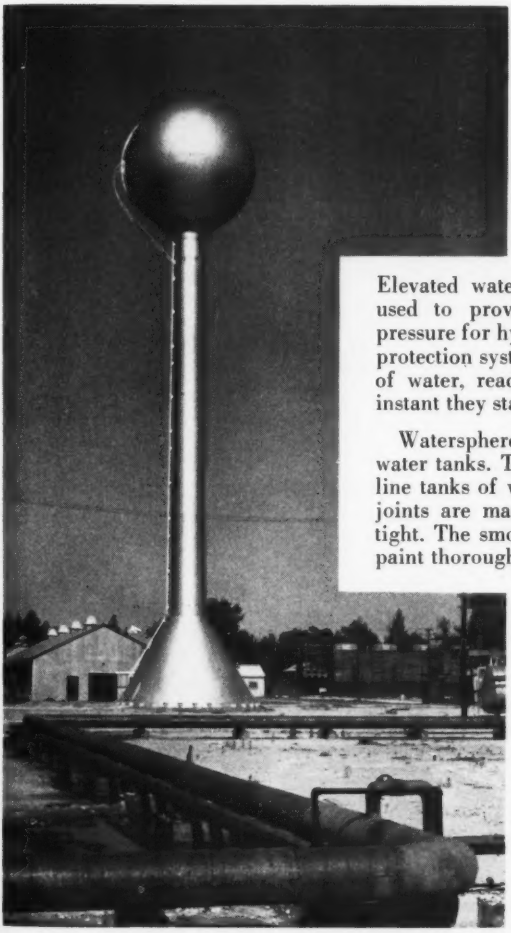
Every functional part is a standard product with years of dependable use to insure for you satisfactory and continued service.

Already approximately three hundred CENTRAL Model "AD" Deluge Sprinkler Systems are now in service protecting vital United States Army and Navy, and privately owned properties, and proving their superior design and operation over older types of deluge systems in adjacent buildings in some of these properties.

Send for illustrated and descriptive bulletin N.P.-V-4.

CENTRAL AUTOMATIC SPRINKLER CO.

FOURTH ST. & CANNON AVE. . . LANSDALE, PA.



FOR FIRE PROTECTION

Elevated water tanks have long been used to provide dependable gravity pressure for hydrant and automatic fire protection systems. They hold a reserve of water, ready to quench flames the instant they start.

Waterspheres are modern elevated water tanks. They are smooth, streamline tanks of welded construction. The joints are made tight and stay water tight. The smooth surfaces are easy to paint thoroughly.

The 100,000-gal. Watersphere at the left supplies gravity water pressure for yard hydrants at the Newport Industries, Inc., new plant at Oakdale, La. It is 113 ft. to bottom.

Write our nearest office for quotations on tank installations. State capacity, height to bottom and location.

CHICAGO BRIDGE & IRON COMPANY

CLEVELAND	CHICAGO	BIRMINGHAM	NEW YORK
HAVANA	DETROIT	ATLANTA	PHILADELPHIA
HOUSTON	TULSA	LOS ANGELES	SAN FRANCISCO
CARACAS	BOSTON	SEATTLE	SALT LAKE CITY

Plants at Chicago, Birmingham, Salt Lake City and Greenville, Pa.

"Eternal Vigilance"

—THE PRICE OF SECURITY!

WHETHER IT BE NATIONAL OR INDIVIDUAL PERFORMANCE . . . SECURITY IS ACHIEVED ONLY BY THE EVER-ALERT, EVER-CAPABLE AND EVER-DEPENDABLE!

All of these requisites for SECURITY against loss of life and property by fire are provided through the "ETERNAL VIGILANCE" of

STAR AUTOMATIC SPRINKLERS

Automatic Sprinklers
Corrosion-Proof Sprinklers
Directional Flow Sprinklers
Open Sprinklers
Spray Sprinklers
Alarm Devices

Automatic Releases
Standard Wet Pipe Systems
Dry Pipe Systems
Deluge Systems
Heat-Actuated Devices
Pre-Action Systems

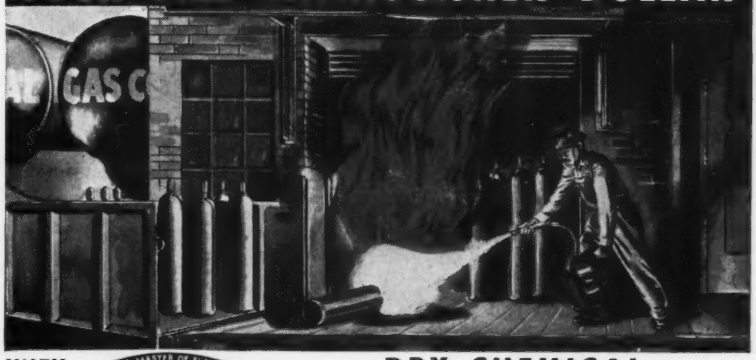
Star Automatic Sprinklers and Fire Protection Devices bear approval of all Insurance Authorities having jurisdiction and various Governmental Agencies.

Economy in installation cost and maintenance has dictated the consistent policy of Star Sprinkler Corporation in distributing its Fire Protection Devices through local licensed contractors who have had a lifetime of experience in the installation of automatic sprinkler systems. Operating throughout the United States, Canada and South America, Star licensees, due to their strategic locations, can render instant service. Write us for name and address of Star licensed contractor nearest your location.

STAR SPRINKLER CORP.

Westmoreland and Collins Sts. — Philadelphia, Pa.

MORE AND BETTER PROTECTION FOR YOUR FIRE EXTINGUISHER DOLLAR



WITH ANSUL — THE MASTER OF FLAME — FIRE EXTINGUISHING EQUIPMENT

DRY CHEMICAL FIRE EXTINGUISHERS

Ansul Dry Chemical Fire Extinguishers give you more protection... pound for pound... dollar for dollar... than any other extinguisher of comparable size. In addition, they provide the best first-aid protection:

● **For hazards involved in storing, transferring and transporting PROPANE, BUTANE and other flammable gases.**

Ansul Fire Extinguishers have the highest ratings for effectiveness on flammable liquid fires, based on tests by nationally recognized approval agencies. The longer range stream of dry chemical is effective in winds and drafts.

After use, Ansul Fire Extinguishers can be recharged "on the spot"... providing continuing protection... and annual recharging of Ansul Fire Extinguishers is NOT necessary.

Ansul Model 20

Safe to use. Non-toxic, non-corrosive, non-abrasive. Ansul Dry Chemical Fire Extinguishers are preferred protection in the L-P Gas Industry.

Ansul Model 4

Ask for your copy of file No. 304. Get the facts on how you, too, can cut your fire protection costs.

Listed and approved by Underwriters' Laboratories and Factory Mutual Laboratories.

ANSUL CHEMICAL COMPANY
FIRE EXTINGUISHER DIVISION, MARINETTE, WISCONSIN
DISTRIBUTORS IN ALL PRINCIPAL CITIES

NOW THERE REALLY ARE

GLASS

"glass curtains"

● Newcomer to the line of UL-listed *noncombustible fabrics*—which the textile industry for years has been weaving of 100% glass yarns—is a *marquisette,* heretofore available only in organic fiber. Production of this fabric woven of Fiberglas* Yarns has been made possible by the Coronizing* process, and gives decorators another permanently firesafe textile to use, without restriction, in hotels, institutions and places of public assembly . . . Glass will not burn. Owens-Corning Fiberglas Corporation, Textile Division, 16 East 56th Street, New York 22, New York.

Distributed by

F. Schumacher & Co., 60 West 40th St., New York, N. Y.
J. H. Thorp & Co., Inc., 250 Park Ave., New York, N. Y.
Thortel Fireproof Fabrics, 101 Park Ave., New York, N. Y.

OWENS-CORNING
FIBERGLAS

*FIBERGLAS is the trademark (Reg. U.S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.

Coron, Coronize, Coronizing and Coronized are trademarks of Owens-Corning Fiberglas Corporation.

Most Durable and Why:

No compromise is made with materials —from the full-jeweled Waltham watchclock movement to the padded, harness-leather carrying case. But, more than that, CHICAGO Watchclocks are the work of master mechanics —career watchclock craftsmen. Their amazing precision-skill results in an unequalled combination of pin-point accuracy and extreme durability. No wonder famous "name" concerns, all over the world, depend on the CHICAGO Watchclock System.

Keys—placed at fixed intervals—make a permanent record on the dial encased in the clock; a daily report of your watchman's performance . . . The cost of this greater-property-protection service soon is refunded through reduced insurance rates! . . . Ask for sample dial (the tell-tale "bird") and details.

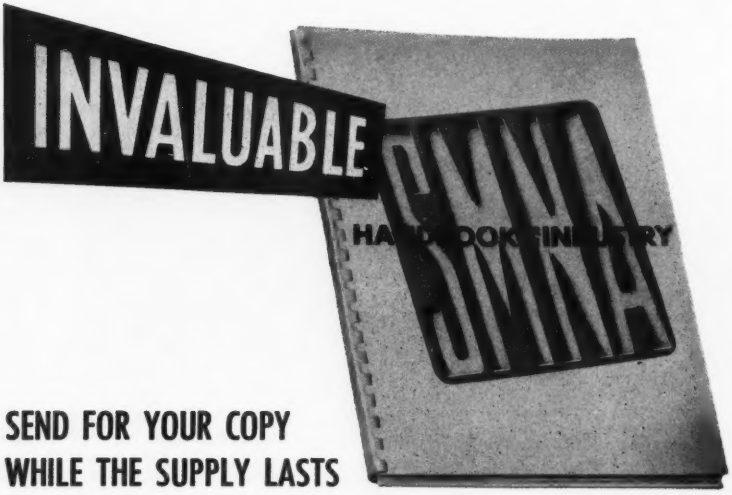
CHICAGO WATCHCLOCK DIV.
GREAT LAKES INDUSTRIES, Inc.
The First—and Still the First

1536 S. Wabash Ave., Chicago 5
Offices in principal cities
FOR OVER 60 YEARS

The CHICAGO System

quickly pays for itself by reducing insurance rates. . . .
APPROVED BY UNDERWRITERS' LABORATORIES, INC.,
and FACTORY MUTUAL LABORATORIES.

———*Send for new, illustrated folder today!*———



SEND FOR YOUR COPY WHILE THE SUPPLY LASTS

This new Manual is the most authoritative and thorough volume ever compiled on the subject of record-protection equipment. An indispensable reference book, well-organized, easy to use. 76 pages of pertinent information concerning the specifications, tests and specific applications of rated safe-industry products; gives aids for measuring fire hazards and record protection needs and other essential data.

Price $1

RELIABLE

AUTOMATIC SPRINKLER DEVICES

PROTECTING LIFE AND PROPERTY FOR OVER 25 YEARS

Reliable Automatic Sprinkler Devices have an excellent field record . . . superb in design and construction . . . are universally approved by all Fire Insurance and Governmental Authorities . . . and effect maximum reductions in fire insurance premiums.

They comprise a complete line including Automatic and Open Sprinklers, Alarm Valves, Dry Pipe Valves, Accelerators, Circuit Closers, Water Motors and all other accessories required in Sprinkler Systems.

Reliable Systems are protecting thousands of properties throughout the United States, Canada and foreign countries.

FURTHER INFORMATION UPON REQUEST

Manufactured and Distributed by

The Reliable Automatic Sprinkler Co. Inc.

BRONX STREET MOUNT VERNON, N. Y.

C-O-Two helped a leading department store solve a fire protection problem

Fire, even a small one, can spread rapidly . . . create panic . . . loss of good will, equipment, buildings and human lives.

Twenty of the electric stairways at Marshall Field & Company in Chicago are now protected from fire by C-O-TWO. Little chance of cigarette butts, matches, overheated motors, or short circuited electrical equipment starting a disastrous fire. The C-O-TWO Combination Smoke Detecting and Fire Extinguishing System automatically detects smoke in the machinery room and the housing of these electric stairways. Upon a signal, non-damaging carbon dioxide is released into the threatened area, controlling the fire before panic and costly damage take place.

Whether your fire protection problem is a store, factory, ship or power plant, an expert C-O-TWO Fire Protection Engineer can help you plan and install adequate fire protection equipment.

Write us today for your free copy of the test report on this installation.

C-O-TWO

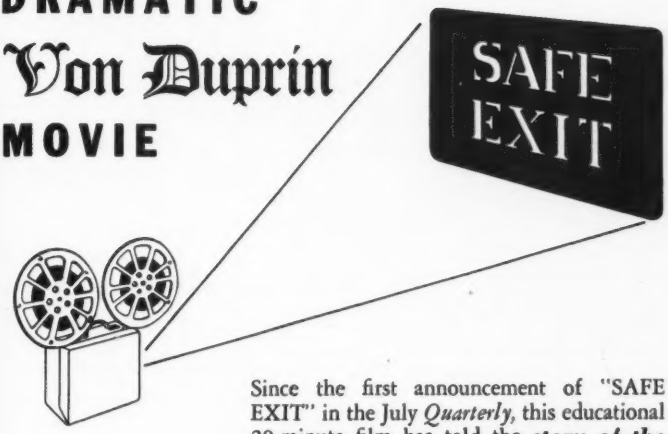
C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 • NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY

WHAT'S HAPPENED TO THE DRAMATIC Von Duprin MOVIE



Since the first announcement of "SAFE EXIT" in the July *Quarterly*, this educational 20-minute film has told the ***story of the vital need for adequate exits*** to scores of audiences. To give you an idea of the kind of people who are enjoying "SAFE EXIT," we list below a few typical bookings.

B48 Safety classes in a Junior High School.
D54 A manufacturing plant's party for the awarding of safety prizes.
B33 Elementary school classes; Parent-Teacher Association meeting.
A32 Safety Engineers and Fire Inspectors meetings; a luncheon club meeting.
C16 Fireman's training course.
C3 Deputy Fire Marshal's training school.
G5 Safety division of a mercantile organization.
A6 Building inspectors convention.
D18 Factory plant protection personnel.
G8 A college's training course for inspectors (fire department personnel).
B11 Parent-Teacher Association meeting.
B42 Elementary school classes; Parent-Teacher Association meeting; several luncheon club meetings.
D10 Foreman's club of a lumber company.
B37 Public, parochial and county school classes.

If you would like to show "SAFE EXIT" to a group, please fill out and mail us the attached blank. The film is 16-mm., black and white, with sound.

VON DUPRIN DIVISION, VONNEGUT HARDWARE CO., INDIANAPOLIS 9, IND.

We desire to show "SAFE EXIT" on (Date).....or.....
Type of audience.....Title.....
Signed.....

9,000 Copies Sold!

Do You Have Yours?

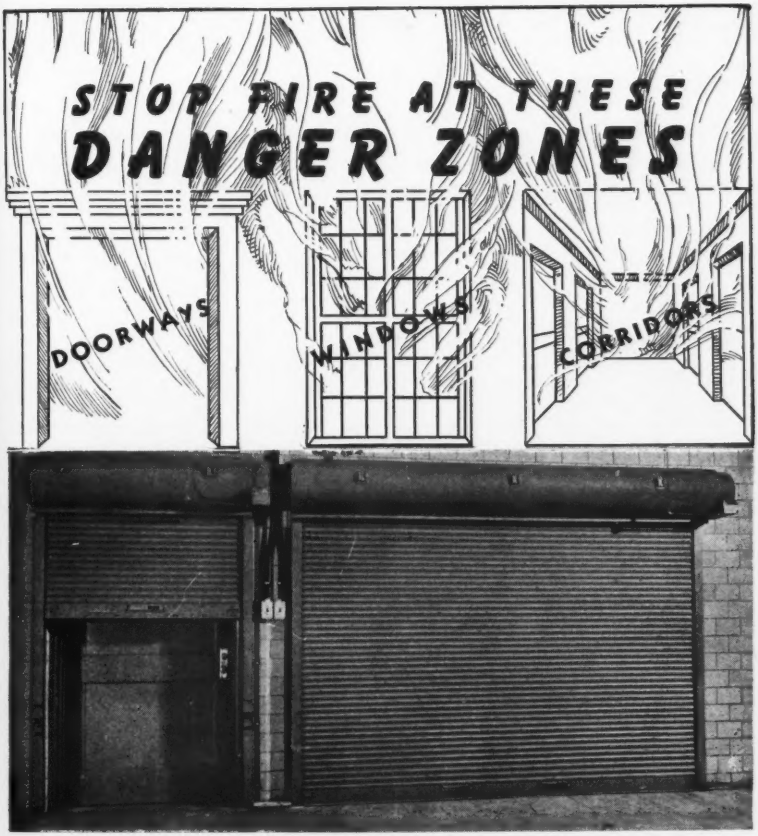
In the five months which have passed since the Tenth Edition of the N.F.P.A. Handbook of Fire Protection was published, 9,000 copies have been sold. This exceeds all previous records for the sale of this well-known reference book and attests to its broad usefulness.

Tremendous advances in fire protection have been made in every branch of the fire engineering field since the Ninth Edition of the Handbook in 1941. The 1948 Tenth Edition contains new and up-to-date information, a good deal of which represents developments that were made during the war — in industry, in fire prevention and in fire extinguishment.

The Handbook is the basis of education for beginners in the fields of fire protection and fire prevention, and is the constant companion of experienced men specializing in these fields. It is an invaluable reference work for those occasionally requiring specific facts of this character. In keeping with the purpose of a reference book, all information is presented clearly, concisely and as far as possible in non-technical language.

Attractively and solidly bound in red fabrikoid, the 5½" x 7½" Handbook contains 1,544 pages, 897 illustrations, and 321 tables. $9.50 per copy.

NATIONAL FIRE PROTECTION ASSOCIATION
INTERNATIONAL
60 Batterymarch St., Boston 10, Mass.



with **KINNEAR ROLLING FIRE DOORS**

Sabotage by fire is now a greater threat to vital production than ever before. And when a fire does break out, open or unprotected doorways, windows and corridors become one of your greatest hazards. Strong drafts can sweep flames through such openings with disastrous speed. But you can *stop fire* at these danger zones with Kinnear "AKbar" Rolling Fire Doors and Window Shutters. They are *fireproof* . . . automatically controlled . . . equipped with a strong, push-down starting spring that assures quick, positive closure. They are *safe*, too, because their downward speed is controlled, to guard against injury to persons passing underneath — and a special counterbalance permits emergency opening after automatic closure. They are approved and labeled by the Underwriters' Laboratories. And Kinnear Rolling Fire Doors can readily be equipped for regular, daily service use, with motor or manual control! Write Kinnear today for the complete story! THE KINNEAR MANUFACTURING COMPANY, 2250-70 Fields Avenue, Columbus, Ohio.

SAVING-WAYS IN DOORWAYS **KINNEAR ROLLING DOORS**

What's **DIFFERENT** *about Globe Protection?*

GLOBE SPRINKLERS

THE AUTOMATIC FIREMEN

Most FIRES are Night FIRES

Statistics shows that most ***FIRES*** occur when help is away . . . a fact that emphasizes the need for GLOBE Sprinkler protection. GLOBE Sprinklers are always on duty . . . always ready for action.

They Pay for Themselves

GLOBE
Automatic Sprinkler Co.
2038 WASHINGTON AVENUE
Philadelphia 46, Pa.
SALES OFFICES IN PRINCIPAL CITIES

WHENEVER

OUR FIRE-PROTECTION

EXPERIENCE

can supplement yours...

Feel free to call on us!

As specialists in the design and application of extinguishing equipment for electrical and flammable liquid fires, we have acquired a mass of information on ways to put out such blazes *rapidly, with minimum damage.*

Perhaps this knowledge can be helpful in supplementing your own. A Kidde representative is ready to work with you at any time.

Any assistance he can offer is, of course, available to you without charge or obligation.

Walter Kidde & Company, Inc.

1051 Main Street, Belleville 9, New Jersey

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Kidde

GUARDIAN OF STORAGE TANK SAFETY

"VAREC" *Approved* Conservation Vent Unit—Fig. No. 58A—guards the vital petroleum products of one of the largest Canadian Refineries.

"VAREC" *Approved* Conservation Vent Units are "Standard" in many refineries throughout the world. Always on the alert to protect the vital resources of the petroleum and chemical industries, these units are the breathing apparatus of storage tanks.

The valve is completely streamlined and is equipped with inside flame snuffer. Specially designed hyperbolic inner valves are less affected by kinetic energy of velocity flow as they operate at the predetermined static pressure, resulting in greater flow capacity with less "blow-down." These units are non-corrosive in most gases and impervious to the attack of sulphurous gases. They require less maintenance. There is less tendency to freeze. Tank Vent Area is always protected from fire. The conservation of valuable "light-ends" soon turns its cost into dividends.

Fully listed by the Underwriters' Laboratories, and approved by the Associated Factory Mutuals Laboratories and other safety authorities, these Vent Units are truly "Guardians of Storage Tank Safety."

"Varec" THE VAPOR RECOVERY SYSTEMS COMPANY
COMPTON, CALIFORNIA, U.S.A.
NEW YORK 30 Church Street · CLEVELAND 1501 Euclid Ave. · CHICAGO 122 So. Michigan Ave. · TULSA 533 Mayo Building · HOUSTON 821A M. & M. Bldg.
Cable: VAREC COMPTON (all codes)

Mayfair Room, Blackstone Hotel, Chicago, Ill.

BLACKSTONE HOTEL redecorates with NON-COMBUSTIBLE fabrics

The Mayfair Room, celebrated for its world-famous star entertainment and epicurean cuisine, above, is one of several public rooms in this famous hotel that have been made more fire-safe through Fiberglas* fabrics. Note the very attractive damask-type design used for both wall covering and draperies—the contrast afforded by solid color swags. These fabrics CANNOT BURN. Woven entirely of finely spun glass filaments, they never require flame-proofing. If exposed to fire will not deplete the oxygen in the air or emit suffocating smoke and fumes. Immune to rot or decay; *always operate at 100% efficiency.*

CORONIZED* FIBERGLAS FABRICS

Coronizing is an entirely new process that gives Fiberglas fabrics greatly improved handling, draping and cleaning qualities. The first of these Coronized Fiberglas fabrics is a marquisette curtain material that is permanently wrinkle-proof and water-repellent. May be hand or machine washed. Requires no ironing, stretching or framing. Now available.

WRITE FOR SAMPLES AND INFORMATION

THORTEL

FIREPROOF FABRICS

FIBERGLAS* Listed by Underwriters' Laboratories, Inc., as "Non-Combustible Fabric"; approved by the Bureau of Standards and Appeals, City of New York.

ARCHITECTS BUILDING, 101 PARK AVENUE, NEW YORK 17, N. Y. • LExington 2-0711

Sales representatives or recommended workrooms in: **BOSTON, BUFFALO, CHICAGO, CLEVELAND, DENVER, DETROIT, KANSAS CITY, LOS ANGELES, NEW ORLEANS, OAKLAND, PHILADELPHIA, PITTSBURGH, PORTLAND, ORE., RICHMOND, SAN FRANCISCO, ST. LOUIS, ST. PAUL, SEATTLE, TOLEDO, WASHINGTON.**

*T.M. Reg. U. S. Pat. Off. Owens-Corning Fiberglas Corp.

REGO
LP GAS EQUIPMENT

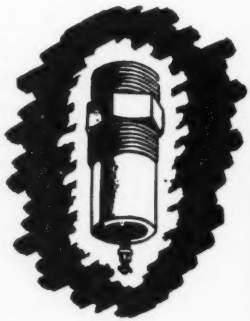
Specified For...

PERFORMANCE PLUS SAFETY!

Here's Why:

- It is listed by Underwriters' Laboratories
- It conforms to N.F.P.A. Standards
- It is manufactured only after thorough field testing
- It is shipped only after being rigidly inspected and tested at the factory

Typical of the many RegO-designed devices for insuring the safe use of LP Gases are RegO Excess Flow Check Valves. These valves, which shut off the flow of fuel should a break in the line occur, may be used with butane or propane in either a gaseous or liquid state. They function with complete efficiency whether mounted vertically or horizontally. A complete range of sizes provides valves suitable for every use, from small domestic installations to large bulk plant or industrial applications.



RegO Excess Flow Check Valves

REGO LP GAS

The BASTIAN-BLESSING Company

4201 West Peterson Avenue Chicago 30, Illinois

PIONEER AND LEADER IN THE DESIGN AND MANUFACTURE OF PRECISION EQUIPMENT FOR USING AND CONTROLLING LP GASES

FIRE CHIEF CANVAS is approved and listed under the reexamination service of the Underwriters Laboratories File No. R-2606.

FIRE CHIEF CANVAS is approved by the Factory Mutual Laboratories.

FIRE CHIEF CANVAS is approved and has the Seal of the California State Fire Marshal, No. A-72

FIRE CHIEF CANVAS meets the requirements of Government Specifications: CCC-D-746—Duck, Cotton, Fire, Water and Weather Resistant.

FIRE CHIEF Finish is available in any of three ways:

- ***Specify*** FIRE CHIEF Finished Hooperwood Duck, or . . .
- ***Send*** fabrics to our mills for FIRE CHIEF treatment, or . . .
- ***Apply*** FIRE CHIEF Compound yourself to new or used canvas.

Manufactured under U. S. Patents No. 2,044,167, No. 2,299,612 and other patents. All owned by Wm. E. Hooper & Sons Co.

UL

FM

REGISTERED A-72

GOVERNMENT SPECIFICATIONS

A PRODUCT OF ***Hooperwood Mills***

From only the best cotton

WM. E. HOOPER & SONS CO.

General Sales Offices:

New York **PHILADELPHIA** Chicago

320 Broadway Juniper & Cherry Sts. 300 W. Adams St.

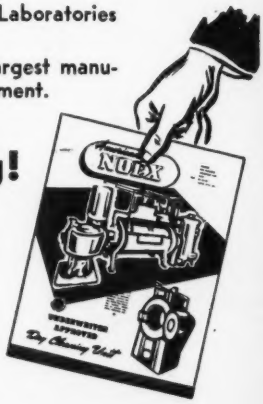
Hooperwood Mills: Woodberry, Baltimore, Md.

FACTS YOU WANT TO KNOW ABOUT NOEX DRY CLEANING UNIT

★ NOEX is designed to give positive safety protection with all listed petroleum solvents having a flash point of 138.2° F., or over.

★ NOEX has been approved by Underwriters' Laboratories as a Class III Unit.

★ NOEX is a quality product of the world's largest manufacturer of laundry and dry cleaning equipment.

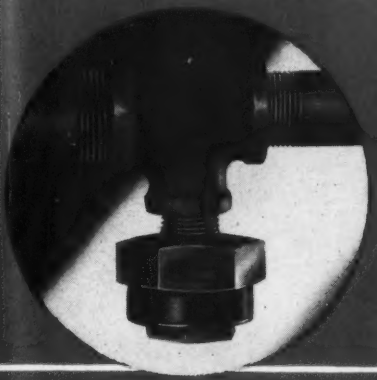


Free! yours for the asking!

NOEX DRY CLEANING UNIT CATALOG

This attractively illustrated catalog explains safety features, operation and advantages of the NOEX Underwriters' Approved Safe Petroleum Solvent Dry Cleaning Unit. WRITE TODAY for your FREE copy!

THE AMERICAN LAUNDRY MACHINERY COMPANY
CINCINNATI 12, OHIO



BLAW-KNOX

FOG NOZZLES

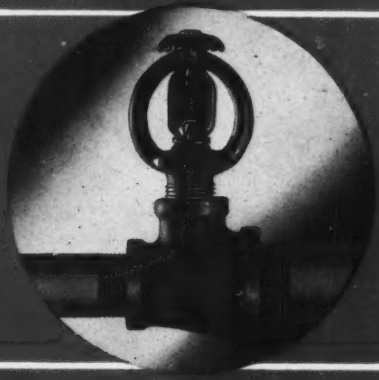
have four fire-fighting features:

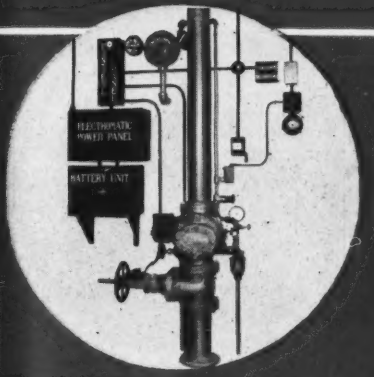
1. NON-CLOGGING—no screens.
2. MAINTAIN PATTERN even at reduced pressures.
3. POWERFUL FOG-PLUS SPRAY reaches base of fire.
4. Delivers MAXIMUM COOLING AND QUENCHING EFFECT

BLAW-KNOX

STANDARD AUTOMATIC SPRINKLER SYSTEMS

are available for either wet or dry pipe installations. Special sprinkler heads for side wall and window protection.





BLAW-KNOX

DELUGE SYSTEMS

are thermostatically controlled and supervised. Thermostats are explosion-proof and operate on both rate of rise and fixed temperature

Write for Bulletin No. 2207

BLAW-KNOX *SPRINKLER DIVISION*

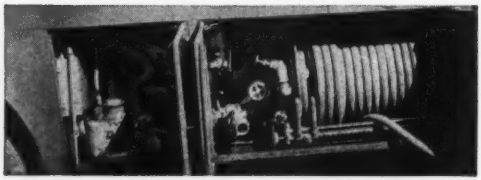
of BLAW-KNOX CONSTRUCTION COMPANY

829 Beaver Ave., N. S., Pittsburgh 12, Pa.

SAFE DELIVERY OF FUEL OIL

While the transportation of stove and furnace oils does not present hazards comparable to the delivery of gasoline, the Sinclair equipment pictured above indicates the great precautions which most major marketers take in assuring safe delivery of their products. This delivery truck is equipped with S. & J. Internal Hydraulic Valves. Normally in a closed position, they are held open by hydraulic pressure against spring tension. They close instantly when the hydraulic pressure is released.

Should a fire occur while unloading, small fusible plugs installed in the hydraulic line will melt and release the hydraulic pressure when subjected to even as much heat as produced by an ordinary match. This is typical of the Sinclair conception of delivering petroleum products in residential areas—MAXIMUM SAFETY ALWAYS.



S&J

SHAND & JURS CO.

BERKELEY, CALIFORNIA

NEW YORK CHICAGO HOUSTON LOS ANGELES SEATTLE

Huge Passenger Plane Saved From Gasoline Spill Fire by New Rockwood FogFOAM Equipment

1. LaGuardia fire fighters in action after they had done a remarkable job of extinguishing huge gasoline fire, using special Rockwood FogFOAM outfit just installed on their crash truck a short time prior to fire.

Type FFF Rockwood FogFOAM Nozzle available for ordinary 1½", 2½" and 3½" hose lines and turret guns.

Over 1,000 gallons of gasoline flashed into a roaring fire on the ground underneath a huge DC-6 airlines passenger plane at the LaGuardia Airport recently. The airport fire fighting and crash crew quickly reached the scene and had the fire under control in a minute and a half. They put out the fire within six minutes.

The plane, gasoline truck and personnel were saved. Good fire fighting plus Rockwood's new FogFOAM equipment made this possible.*

Today, this remarkable new FogFOAM equipment will enable you to extinguish large spill fires in gasoline with speed not possible with old style chemical or mechanical foam apparatus. It protects the firemen from intense heat and fumes. This new Rockwood FogFOAM equipment will also pay for itself in a few fires by the more efficient and economical use of foam.

We recommend this new equipment to every municipal fire department for handling the increasing hazard of large gasoline spill fires resulting from tank truck crashes in your city streets. It also offers you the solution to the airplane crash fire hazard.

* Write for detailed story of this airport gasoline fire and literature on the new Rockwood FogFOAM equipment.

2. Gasoline fire was quickly put out by this foam blanket applied by Rockwood's new FogFOAM equipment. Note how thoroughly foam *blankets* running gasoline and clings to trucks and other equipment.

3. Here you see location of gasoline truck and plane when hose line coupling broke spilling gasoline on ground underneath plane, gasoline truck and baggage trucks. Note front of airport crash fire fighting truck in right foreground.

ROCKWOOD

ROCKWOOD SPRINKLER COMPANY

56 HARLOW STREET • WORCESTER 5, MASSACHUSETTS

Specialists in Fire Protection Engineering, Equipment and Installation since 1907

Wanted . . .

a champion to fight this menace

. . . a menace which levies on Americans an annual tribute approaching $700,000,000 and 8,350 lives. Virtually every community in the land has urgent need of a champion to spearhead its fire prevention activities. Will you step forward? Will you take up the weapon of education and use it vigorously against ignorance and carelessness — the chief causes of fire?

We stand ready to arm our agents from a large and varied arsenal of sound-color movies, posters, talks, booklets, action displays.

You may also secure ammunition from the National Board of Fire Underwriters and other sources.

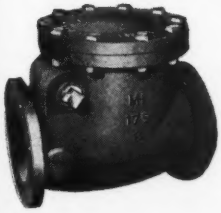
The need is urgent. The rewards are substantial . . . both in personal satisfaction, and in the kind of community-wide recognition and goodwill that builds future business.

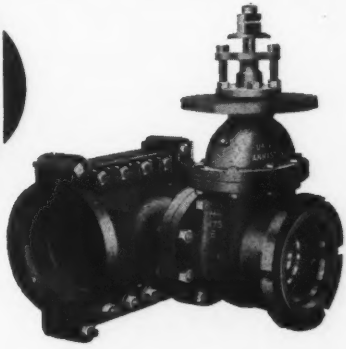
Will you step forward today as your community's champion against fire?

AUTOMOBILE INSURANCE COMPANY
STANDARD FIRE INSURANCE COMPANY
HARTFORD, CONNECTICUT

FIRE AND MARINE INSURANCE . ALL FORMS

Affiliated with
ÆTNA LIFE INSURANCE COMPANY
ÆTNA CASUALTY & SURETY COMPANY





VALVES, HYDRANTS Indicator Posts and Pipe Fittings For FIRE PROTECTION

We make a complete line of Valves, Hydrants, Indicator Posts and underground pipe fittings for fire protection systems. All M&H products are approved and listed by the Underwriters' Laboratories and A.F.M. Laboratories. Outstanding features are simplicity of design, rugged construction and highest quality materials and workmanship. Write for CATALOG No. 40. On your orders specify M&H for service.

Top, Left: Swing Check valve.

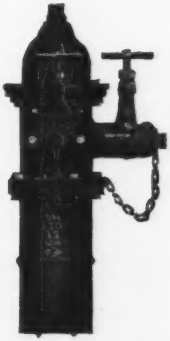
Above: Tapping Sleeve and valve to tap a main under pressure.

Right: Rising Stem Gate Valve, bronze mounted.

Below, Right: Mill Yard Hydrant, Independent Hose Gate Valves.

Left: Adjustable Indicator Post.

Right: All-bell Cast Iron Tee.



M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

In The Background Till Fire Strikes

Fits in smoothly with the most modern interiors. Barely visible, but ready at a second's warning to spring into action. Viking Flush Type Sprinkler Heads offer great *dependability*, plus true functional design. Get all details today from the *Viking* representative in your neighborhood.

THE VIKING FLUSH TYPE SPRINKLER HEAD

VIKING CORPORATION REPRESENTATIVES

Crawford & Slaten Co.
Atlanta, Georgia

Crawford Sprinkler Co.
Charlotte, North Carolina

Hudson Viking Sprinkler Co.
St. Paul, Minnesota

C. W. Hutchinson, Inc.
Huntington, West Virginia

Texas Automatic Sprinkler Co.
Dallas, Texas
Houston, Texas
San Antonio, Texas
Jackson, Mississippi
Memphis, Tennessee
New Orleans, Louisiana
Oklahoma City, Oklahoma

Walton Viking Co.
Kansas City, Missouri
St. Louis, Missouri

Viking Sprinkler Co., Inc.
Boston, Massachusetts

Viking Automatic Sprinklers, Inc.
Buffalo, New York

Viking Automatic Sprinkler Co.
Chicago, Illinois

Viking Sprinkler Co.
Cincinnati, Ohio
Cleveland, Ohio
Pittsburgh, Pennsylvania
Indianapolis, Indiana

Viking Sprinkler Co.
Detroit, Michigan

Viking Sprinkler Co.
Grand Rapids, Michigan

Northwestern Sprinkler Co.
Los Angeles, California

Viking Sprinkler Co.
New York, New York

Viking Sprinkler Co.
Philadelphia, Pennsylvania

Viking Automatic Sprinkler Co.
Salt Lake City, Utah

Viking Automatic Sprinkler Co.
Seattle, Washington
Portland, Oregon
Vancouver, B. C.

THE VIKING CORPORATION
HASTINGS, MICHIGAN

TRAMP IRON

A DANGEROUS TRAVELER UNLESS YOUR PROTECTION IS *Eriez* MAGNETS . . .

1. Comply with NFPA Dust Explosion Codes.
2. Entirely *Non-Electric* – cannot Spark.
3. Magnetic Field Guaranteed to Last.
4. Lowest Initial Cost.
5. No Operating Cost. No Repair Cost.
6. Lightest and Most Compact.
7. Easiest to Install.
8. Made Any Size to Fit Your Requirements.
9. MOST PROTECTION PER DOLLAR.

Hinged types approved by Mill Mutual Fire Prevention Bureau for Class A or Class B installation.

PATENT PENDING

ERIEZ Non-Electric Permanent Magnets are preferred equipment in Milling, Chemicals, Plastics, Textiles and General Industrial fields to remove tramp iron, cause of fires and explosions.

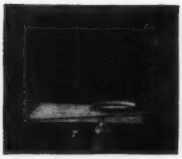
Write today for Bulletin 101A (Milling), 102B (Industrial), 104A (Textiles), 501A (Pulley), 600 (Drum).

When It's Magnetic Protection . . . See Eriez First

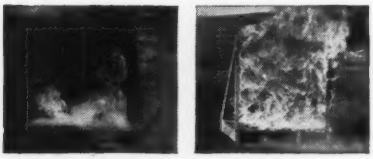
ERIEZ MANUFACTURING COMPANY

39 East 12th Street · Erie Pennsylvania

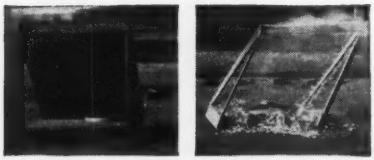
TESTS CONFIRM...



Test structures built of Koppers fire-retardant wood (left) and untreated wood (right) ready for the fire test. Five quarts of kerosene, placed in pans, furnishes fuel for each blaze.



Both structures are quickly enveloped in flame. Treated structure resists fire, but untreated one encourages it, contributes fuel to the fire.



After twenty-two minutes the untreated structure, still burning, is collapsing. Note that in the treated structure, the fire stopped when the fuel burned out.

KOPPERS

KOPPERS PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC.
PITTSBURGH 19, PA.

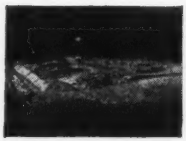
fire retardance of KOPPERS CZC(FR)

Koppers fire-retardant wood is suitable for use as flooring, roofing, sheathing and structural members of industrial buildings, garages, airplane hangars, munitions plants, docks and warehouse buildings, railroad engine houses, and other similar structures. Koppers CZC(FR) treatment has a valuable plus advantage, for it also fortifies the wood against decay and termite attack. Color and paintability are not harmed by the odorless CZC(FR) treatment.

Investigate the possibilities of this new Koppers development. Send for your copy of the booklet, "Koppers Fire-Retardant Wood." Filled with interesting, helpful information.

Right · The treated structure was charred . . . but retained its integrity and strength, as the 800 pound load shows.

Left · Continued burning reduced the untreated structure to ashes.



there's a Pyrene for every fire hazard

*REG. U.S. PAT. OFF.

PYRENE* VAPORIZING LIQUID EXTINGUISHERS

are especially effective for electrical fires, flammable liquid fires, and surface fires in wood, paper and textiles. 2-qt. (illustrated) and 1-gallon pressure type; 1 and 1½-qt. pump type.

PYRENE CARTRIDGE-OPERATED EXTINGUISHERS

require no pumping, no annual recharging . . . the gas cartridge supplies pressure to shoot a stream 40 feet. Ideal for fires in ordinary combustibles. Water or Anti-Freeze types, 2½-gal. capacity.

PYRENE FOAM FIRE EXTINGUISHERS

produce plenty of fast-acting foam that quickly smothers fires in flammable liquids and ordinary combustibles. Available in 2½-gal. size, as illustrated; also in 10-gal. and 40-gal. sizes, mounted on wheels; and in manual and automatic systems.

*T.M. Reg. U. S. Pat. Off.

OR you may need PYRENE Soda-Acid and Pump Tank Extinguishers.

Every PYRENE is precision-made for *sure* protection.

PYRENE MANUFACTURING COMPANY

582 BELMONT AVE., NEWARK 8, NEW JERSEY

AFFILIATED WITH C-O-TWO FIRE EQUIPMENT CO.

Write for the name of your nearest PYRENE jobber

At Last !

3-inch size shown above

A WATERFLOW SWITCH *with*

INSTANTLY RECYCLING PNEUMATIC RETARD

(No build-up)

Easily set for any period up to one minute.

- **Underwriters' Approved**
- **Paddle of Non-corrodible Monel**
- **Bell Wiring is Only Electrical Connection**
- **Easily Installed in All Sizes From 2½" Up**
- **Eliminates False Alarms due to Water Surges**

Where many waterflow switches are necessary, transmitters can be substituted for the switches, thereby saving enormously on the wiring system as only two wires would be necessary to take care of any number of transmitters. No necessity to reduce number of alarm valves due to cost. Night watch and fire alarm boxes may be installed on same wiring with waterflow transmitter system. Easily installed by merely drilling a one and seven-eighths inch hole in pipe.

WRITE FOR FULL DETAILS

CENTRAL STATION SIGNALS, INC.

MANUFACTURERS OF FIRE PROTECTION EQUIPMENT

71 WEST 23rd STREET -:- NEW YORK 10, N. Y.

A distinctive door—with a tufted covering of Tolex fire-resistant leathercloth.

Flame test demonstrates fire-resistant properties of Tolex.

A Forward Step in Fire Prevention!

TOLEX* **Fire-Resistant UPHOLSTERY**

● More and more places of public gathering today are cutting down fire hazards by the use of fire-resistant TOLEX plastic leathercloth for upholstery, wall coverings and decoration.

TOLEX is certified to be FIRE RESISTANT by large cities like Boston and New York.

In line with this trend—the public buildings of your city can offer greater safety where TOLEX fire-resistant upholstery is used.

Consulting Service available to you! Without charge or obligation, we will gladly send our technical representative to discuss fire-resistant leathercloth specifications and test methods with fire marshals, fire departments, fire prevention boards or underwriters. Write to . . . Textileather Corporation, Toledo, Ohio.

35 Years of Leadership in Leathercloth

*Reg. U.S. Pat. Off.

All good things are cheap; all bad are very dear.
—Thoreau

NEW FOAM CHARGE

FOR ALCOHOL, ACETONE, ETHER FIRES

Fire Tested Foam Charge Developed For Special Risks...

Useable In Regular 2½ Gallon Extinguishers

Now, after many years of research and testing under the most stubborn fire conditions National Foam introduces an all-purpose foam charge for special risks—National 99

National 99 has been developed especially for inflammable liquid fires involving alcohol, acetone, ether and polar solvents in general as well as petroleum products Its foam action effectively covers and snuffs out the flames in a matter of seconds The thick, tough, long-lasting, air-tight blanket of foam insulates threatened areas and prevents flashbacks.

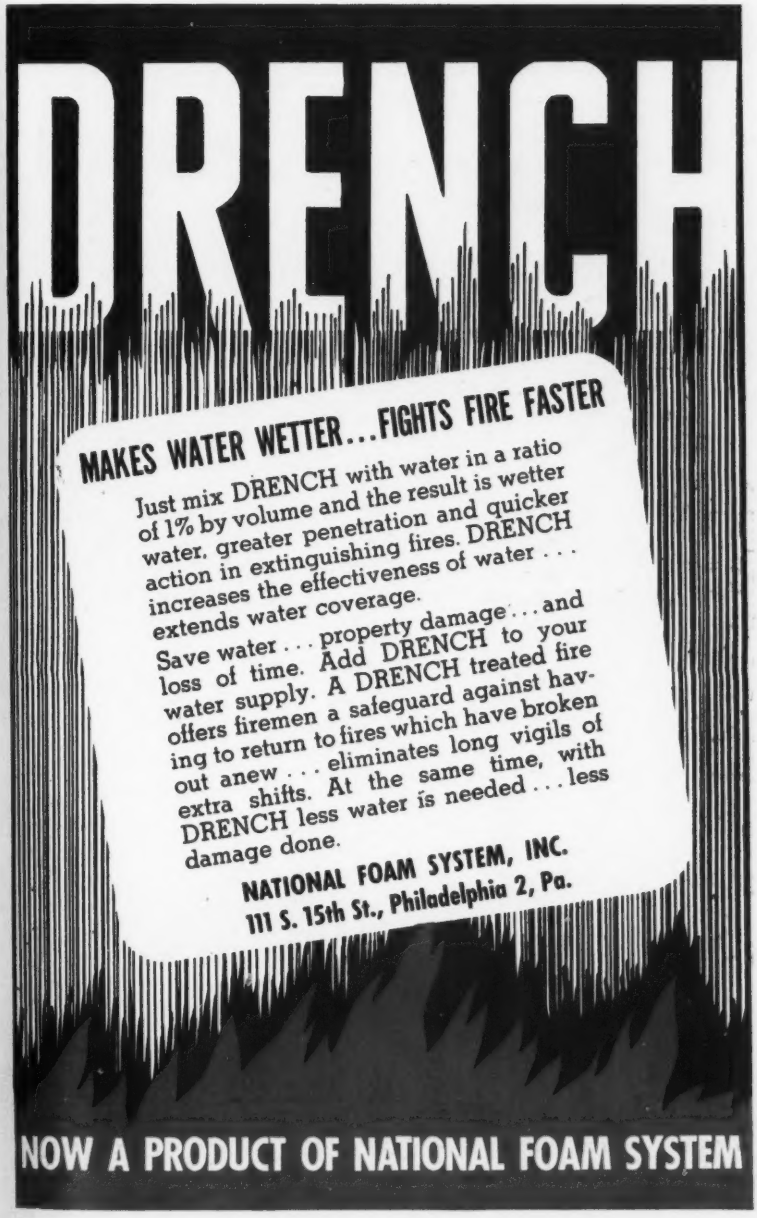
This new foam development is the answer to industry's need for an efficient extinguishing agent that will readily control fires involving alcohol, acetone, ether and other polar solvents. National 99 can be used in regular 2½ gallon foam type extinguishers

Look into this new development now . . . contact National Foam fire engineers They will supply you with complete details and how to use it more effectively in your plant

NATIONAL FOAM SYSTEM, INC.

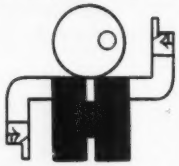
Headquarters for Foam Fire Protection

Parkard Building, Philadelphia 2, Pa.

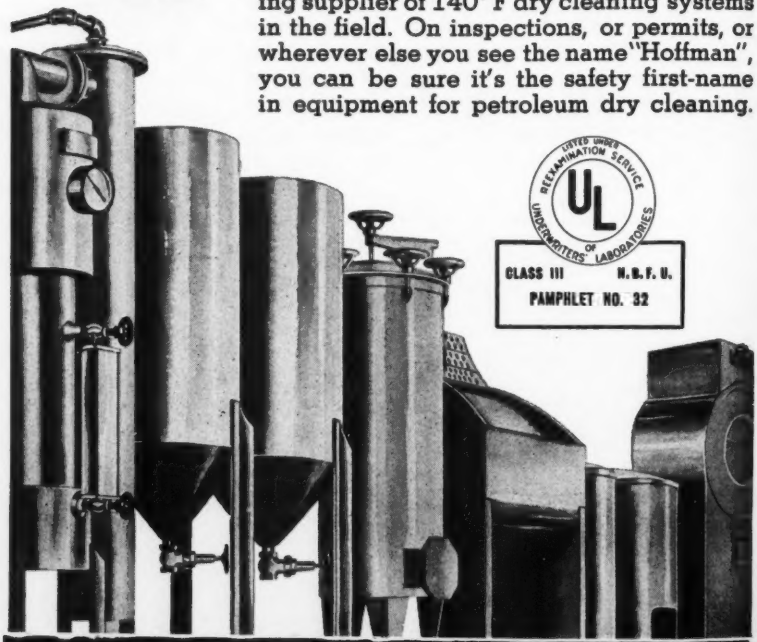

DRENCH
MAKES WATER WETTER...FIGHTS FIRE FASTER
Just mix DRENCH with water in a ratio of 1% by volume and the result is wetter water, greater penetration and quicker action in extinguishing fires. DRENCH increases the effectiveness of water . . . extends water coverage.
Save water . . . property damage . . . and loss of time. Add DRENCH to your water supply. A DRENCH treated fire offers firemen a safeguard against having to return to fires which have broken out anew . . . eliminates long vigils of extra shifts. At the same time, with DRENCH less water is needed . . . less damage done.
NATIONAL FOAM SYSTEM, INC.
111 S. 15th St., Philadelphia 2, Pa.
NOW A PRODUCT OF NATIONAL FOAM SYSTEM

PROVED by a 12-Year CLEAR LOSS RECORD

HOFFMAN 140-F UNITS FOR SAFE DRY CLEANING



Year after year, the safety of commercial dry cleaning with 140° flash-point, petroleum solvent has been proved by Hoffman equipment. Hoffman originated the process in 1935 and, ever since, has been the leading supplier of 140° F dry cleaning systems in the field. On inspections, or permits, or wherever else you see the name "Hoffman", you can be sure it's the safety first-name in equipment for petroleum dry cleaning.



U. S. HOFFMAN MACHINERY CORPORATION
105 Fourth Ave., New York 3, N.Y.
DRY CLEANING, LAUNDRY & GARMENT PRESSING EQUIPMENT

ADVANCE REPORT

to professional people engaged in fire prevention

25 years pioneering in the control of flammable liquids have resulted in a 3-point plan singularly effective in helping industry stop fires before they start.

. . . . . *Educate Industry on Flammable Liquids*

Inspired by able cooperation of fire prevention engineers, fire marshals, and safety directors, PROTECTOSEAL continues to crusade for greater fire safety. Several phases to broaden the effectiveness of the *"Protectoseal System for Safety"* are now available, or in preparation: 20-minute movie dramatizing common causes of industrial fire and explosion; trained field men to assist in plant inspection; group demonstration and lectures on scientific control of flammable liquids and their vapors; a new and compelling series of advertisements emphasizing to industry the need for greater attention to proved fire prevention methods; a new technique to facilitate plant inspection where flammables are a factor.

. . . . . *Cooperate with Fire Prevention Factors*

All facilities of PROTECTOSEAL, its engineers, its field inspectors, its educational bureau are available on call (without cost or obligation) to persons, companies or groups devoted to the reduction of loss of life and property by fire. Reprints of informative ads, booklets, catalog materials and this new technique for plant inspection of flammables . . . all yours for the asking. Some phases of this program may conceivably be of value in your work, so we hope you will register now to be sure of receiving announcements as this program progresses.

. . . . . *Provide Approved Fire Prevention Equipment*

To create, design, develop and produce an ever increasing line of products to safeguard industry from the hazards of fire and explosion by scientific control of flammable liquids and their potentially dangerous vapors is our objective. The PROTECTOSEAL SYSTEM is more than a plan, it is a creed to provide safety appliances — both standard and custom made — to help industry *stop fires before they start.*

THE PROTECTOSEAL COMPANY

1972 SOUTH WESTERN AVENUE, CHICAGO 8, ILLINOIS

55 DISTRICT OFFICES

FIRE PROTECTION ON A NATIONWIDE BASIS

BY "Automatic" Sprinkler

FIRST IN FIRE PROTECTION

More than a half century of leadership in the design, manufacture and installation of approved systems for fire protection . . . 55 district offices serving the length and breadth of a nation . . . Canada and South America, that's what "Automatic" Sprinkler offers business, industrial, commercial and institutional alike.

These factors should be of utmost importance to those considering the purchase of such equipment, for wherever business is located, "Automatic" Sprinkler continues to provide **investment protection,** *returning dividends to the investor in both safety and dollars.*

You owe it to yourself, your personnel and your business to become fully informed on the merits of "Automatic" Sprinklers, *an important investment today . . . perhaps welcomed protection tomorrow.*

"Automatic" Sprinkler

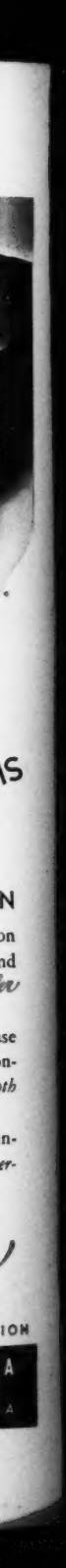
FIRST IN FIRE PROTECTION

DEVELOPMENT • ENGINEERING MANUFACTURE • INSTALLATION

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA

YOUNGSTOWN 1, OHIO

OFFICES IN PRINCIPAL CITIES OF NORTH and SOUTH AMERICA



WHY CITIES PREFER GAMEWELL

2 Reasons are—Economy and Dependability

Many Gamewell fire alarm boxes still in use have service records exceeding 70 years, and — Obsolescence, due to the production of later models affording greater protection, not deterioration, is generally the cause of retiring Gamewell boxes from service.

Gamewell Three-Fold Fire Alarm Box

The Standard for Municipal Service

For the protection of the values at risk — human life, property, business and income — adequate fire alarm box distribution is a sound investment.

THE GAMEWELL COMPANY

Newton Upper Falls 64 - Massachusetts

RESPONSIBILITY CENTRALIZED

Every type of Fire Protection System is available through Grinnell and is installed by Grinnell. Each installation is engineered to meet specific conditions.

The components of all of these systems, with the exception of the pipe, are manufactured in Grinnell plants. A Grinnell System is, therefore, a manufactured unit rather than an assembly of parts from different sources.

Responsibility for the installation is thus centralized . . . a factor of utmost importance to any prospective purchaser. Grinnell Company, Inc., 277 West Exchange Street, Providence 1, R. I. Offices in principal cities.

GRINNELL SYSTEMS

Protection Against Fire